

# USDA's Food Guide

## Background and Development

Human Nutrition  
Information  
Service

Miscellaneous  
Publication  
Number 1514





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United States  
Department of  
Agriculture

Human Nutrition  
Information  
Service

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Prepared by  
Susan O. Welsh  
Carole Davis  
Anne Shaw

Nutrition Education Division  
Human Nutrition Information Service  
U.S. Department of Agriculture  
Federal Building  
Hyattsville, Maryland 20782

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## I. HISTORY OF USDA FOOD GUIDES, 1916-1980

Although advice on what to eat undoubtedly predates recorded language, a science-based approach to achieving a healthful diet began just about a century ago. W.O. Atwater, pioneer nutrition investigator and the first director of the Office of Experiment Stations in the U.S. Department of Agriculture (USDA), is credited with being the first to develop several of the components needed for a food guide. In 1894, he published tables of food composition and dietary standards for the U.S. population (Atwater, 1894). The first food tables provided data on the protein, fat, carbohydrate, ash (mineral matter), and "fuel" value for some commonly available foods. Atwater's dietary standards were intended to represent the average needs of man for protein and total calories; fat and carbohydrate at unspecified levels were to provide the balance in calories. Specific mineral and vitamin needs were unknown.

Atwater initiated the scientific basis for connecting food composition, dietary intake, and health. In a Farmer's Bulletin published in 1902, he stated: "Unless care is exercised in selecting food a diet may result which is one-sided or badly balanced--that is, one in which either protein or fuel ingredients [carbohydrate and fat] are provided in excess" (Atwater, 1902, p. 45). "The evils of overeating may not be felt at once, but sooner or later they are sure to appear--perhaps in an excessive amount of fatty tissue, perhaps in general debility, perhaps in actual disease" (Atwater, 1902, p. 38). This initiated the ongoing dietary guidance themes of variety, balance, and moderation.

While research on food composition and nutritional needs is a key element in the development of science-based food guidance, Atwater did not develop what we think of as the first food guide. He did, however, set the stage for development: "... for the great majority of people in good health, the ordinary food materials--meats, fish, eggs, milk, butter, cheese, sugar, flour, meal, and potatoes and other vegetables--make a fitting diet, and the main question is to use them in the kinds and proportions fitted to the actual needs of the body" (Atwater, 1902, p. 38). A food guide answers this question. It provides a conceptual framework for selecting the kinds and amounts of foods of various types which together provide a nutritionally satisfactory diet. A food guide translates recommendations on nutrient intake into recommendations on food intake.

Food guides, consisting of food groups as we know them, did not appear in USDA publications until 1916 (table 1).

Caroline L. Hunt, a nutrition specialist in USDA's Bureau of Home Economics, is generally credited with developing the first food guide. In this guide, foods were categorized into five food groups--milk and meat; cereals; vegetables and fruits; fats and fat foods; and sugars and sugary foods. The criteria for grouping foods were based on what was known then about nutritional needs and food composition. The amounts of foods were listed in familiar household units, and menus and recipes were provided.

The first daily food guide using this system was published in 1916 in *Food for Young Children* (Hunt, 1916). This was followed in 1917 by dietary recommendations, also based on these five food groups, targeted to the general population in *How to Select Foods* (Hunt & Atwater, 1917). In 1921, a guide for the average family was released using these same food groups and suggesting the amounts of food to purchase *each week* (Hunt, 1921). This publication was slightly modified in 1923 for use by teachers and extension workers in teaching housekeepers (Hunt, 1923). This bulletin used the same five food groups and described amounts of food by weight, volume, or count, and 100-kcal portions to meet the daily needs of all housekeepers, including households that differed from what was then considered the average family size of five members.

In the early 1930's, the economic constraints of the Depression influenced the development of food guides. Families needed advice on how to select foods economically. In 1933, Hazel K. Stiebeling, a food economist in USDA's Bureau of Home Economics, developed a buying guide to help people shop for foods (Stiebeling & Ward, 1933). It was in the form of family food plans at different cost levels. The plans defined the amounts of foods to buy and use in a week at four cost levels to meet the nutritional needs of men, women, and children of different ages. These first family food plans were outlined in terms of 12 major food groups--milk; potatoes and sweetpotatoes; dry beans, peas, and nuts; tomatoes and citrus fruits; leafy green and yellow vegetables; other vegetables and fruits; eggs; lean meat, poultry, and fish; flours and cereals; butter; other fats; and sugars. These food plans recognized that some groups of foods, such as cereal foods, potatoes, and dry beans, supply nutrients more cheaply than others and that the nutritive values of food groups supplement each other. Stiebeling emphasized in her guidance the importance of having a proper balance between "protective" or nutrient-dense foods and high-energy foods. "Protective" foods furnish essential nutrients, such as milk for calcium and vegetables and fruits for vitamins A and C. Fats and sweets are examples

Table 1. Principal USDA Food Guides Through the Years (1916-1992)

(All food guide recommendations are for daily servings (svg), except where otherwise indicated)

FOOD GUIDE	NO. OF FOOD GROUPS	PROTEIN-RICH FOODS			BREADS	VEGETABLES				FRUIT	OTHER	
		MILK	MEAT				POTATOES SWEET POTATOES	OTHER VEGETABLES & FRUIT	TOMATOES & CITRUS		FATTY FOODS 20% cal	SUGARS 10% cal
1916 Caroline Hunt <sup>a</sup> buying guides	5	MEATS AND OTHER PROTEIN-RICH FOOD 10% cal milk, 10% cal other  1 c milk + 2-3 svgs other (based on 3 oz svg)			CEREALS AND OTHER STARCHY FOODS 20% cal 9 (based on 1 oz or 3/4 c dry cereal svg)	VEGETABLES AND FRUIT 30% cal 5 (based on average 8 oz svg)					FATS 9 (based on 1 Tbsp svg)	SUGARS 10 (based on 1 Tbsp svg)
1930's H. K. Stiebeling <sup>b</sup> buying guide	12	MILK 2 c	LEAN MEAT, POULTRY FISH	DRY MATURE BEANS, PEAS, AND NUTS	EGGS 1/wk	As desired	LEAFY GREEN YELLOW 11-12/wk	POTATOES SWEET POTATOES 1	OTHER VEGETABLES & FRUIT 3	TOMATOES & CITRUS 1	BUTTER OTHER FATS --	SUGARS --
1940's Basic Seven <sup>c</sup> foundation diet	7	MILK AND MILK PRODUCTS  2 c or more			MEAT, POULTRY, FISH, EGGS, DRIED BEANS, PEAS, NUTS 1-2	BREAD, FLOUR, AND CEREALS every day	LEAFY GREEN YELLOW 1 or more	POTATOES & OTHER FRUIT & VEGETABLES 2 or more	CITRUS, TOMATO, CABBAGE SALAD GREENS 1 or more	BUTTER-FORTIFIED MARGARINE some daily		
1956-70's Basic Four <sup>d</sup> foundation diet	4	MILK GROUP 2 c or more			MEAT GROUP 2 or more (2-3 oz svg)	BREAD, CEREAL 4 or more (1 oz dry, 1 slice, 1/2-3/4 c cooked)	VEGETABLE-FRUIT GROUP 4 or more (incl. dark green/yellow vegetables frequently and citrus daily 1/2 c or average size piece)					
1979 Hassle-Free <sup>e</sup> foundation diet	5	MILK-CHEESE GROUP 2 (1 c, 1-1/2 oz cheese)			MEAT, POULTRY, FISH AND BEANS GROUP 2 (2-3 oz svg)	BREAD-CEREAL GROUP 4 (1 oz dry, 1 slice, 1/2-3/4 c cooked)	VEGETABLE-FRUIT GROUP 4 (incl Vitamin C source daily and dark-green/yellow vegetable frequently 1/2 c or typical portion)				FATS, SWEETS, ALCOHOL GROUP use dependent on calorie needs	
1984+ Food Guide Pyramid <sup>f</sup> total diet	6	MILK, YOGURT, CHEESE 2-3 (1 c, 1-1/2 oz cheese)			MEAT, POULTRY, FISH, EGGS, DRY BEANS, NUTS 2-3 (5-7 oz total/day)	BREADS, CEREALS, RICE, PASTA 6-11 • whole grain • enriched (1 slice, 1/2 c cooked)	VEGETABLE 3-5 • dark green/deep yellow • starchy/legumes • other (1 c raw, 1/2 c cooked)				FATS, OILS, SWEETS, total fat not to exceed 30% cal sweets vary according to caloric need	

a. "Food for Young Children" (1916), "How to Select Foods" (1917), "A Week's Food for an Average Family" (1921), "Good Proportions in the Diet" (1923)

b. "Planning for Good Nutrition" (1939) (published two previous food plans, 1933/36)

c. "National War-time Nutrition Guide" (1943), "National Food Guide" (1946)

d. "Essentials of An Adequate Diet" (1956), "Food for Fitness--A Daily Food Guide" (1958)

e. Food: "The Hassle-Free Guide to a Better Diet" (1979)

f. "Developing the Food Guidance System for 'Better Eating for Better Health'" (1985)

**Table 2. Early World War II Era Daily Food Guides**

(All food guide recommendations are for daily servings (svg), except where otherwise specified)

FOOD GUIDE	NUMBER OF FOOD GROUPS	PROTEIN-RICH FOODS			BREADS	VEGETABLES		FRUIT	OTHER		
"Eat the Right Food to Help Keep You Fit" <sup>a</sup>	10	MILK  2 c or more	EGGS  1- or at least 3-4 /wk	MEAT  1 or more	CEREAL-BREAD  at least 2 whole grain or enriched	LEAFY GREEN YELLOW  1 or more	OTHER VEGETABLE FRUIT  2 or more	CITRUS TOMATO CABBAGE  1 or more	FATS  use every day	SWEETS  in moderation	WATER  6 or more glasses
"A Yardstick for Good Nutrition" <sup>b</sup>	9	MILK  2 c	EGGS  3-4/wk	MEAT  1  (3 oz svg)	CEREAL-BREAD  at least half of intake	VEGETABLE  2 one green or yellow	POTATO  1 or more	FRUIT  2 one citrus or tomato	BUTTER-FORTIFIED OLEO  100-500 calories		SUGAR-FAT  to complete calories
"A Guide to Good Eating" <sup>c</sup>	7	MILK  2 c or more	EGGS  3-5/wk 1/d preferred	MEAT CHEESE LEGUMES  1 or more	CEREAL-BREAD  whole grain or enriched	VEGETABLES  2 or more besides potato; incl. green/yellow		FRUIT  2 or more incl. citrus or tomato	BUTTER  2 Tbsp or more		

a. U.S. Department of Agriculture, Bureau of Home Economics (1941)

b. National Research Council, "Recommended Dietary Allowances" (1941)

c. National Dairy Council (1941)

of high-energy foods. Research to provide guidance on obtaining a healthful diet at different cost levels has continued to the present time in USDA (Cofer, Grossman, & Clark, 1962; Peterkin, Chassy, & Kerr, 1975; and Cleveland & Kerr, 1989). In fact, one of the lower cost food plans (Thrifty Food Plan) is the basis for food stamp program allotments.

The Food and Nutrition Board of the National Academy of Sciences released the first Recommended Dietary Allowances (RDA) at the 1941 National Nutrition Conference for Defense. These RDAs listed specific recommended intakes for calories and nine essential nutrients--protein, iron, calcium, vitamins A and D, thiamin, riboflavin, niacin, and ascorbic acid (vitamin C). The conference also addressed the need for public education, and with the exigencies of wartime food restrictions, there was a demand for simple, practical nutrition education materials to promote improved food choices. As a result, many private groups and government agencies developed media-type materials--posters,

pamphlets, food charts, and press kits. Among the daily food guides developed in the early 1940's were *Eat the Right Food to Help Keep You Fit* (USDA/Bureau of Home Economics, 1941), the *Yardstick for Good Nutrition* (National Research Council, 1941), and the *Guide to Good Eating* (National Dairy Council, 1941). These food guides were similar to each other, with the number of food groups ranging from 7 to 10 (table 2).

In 1943, the "Basic Seven" food guide was issued as the leaflet, *National Wartime Nutrition Guide* (USDA/WFA, 1943). The guide included the following food groups: 1) green and yellow vegetables; 2) oranges, tomatoes, and grapefruit; 3) potatoes and other vegetables and fruits; 4) milk and milk products; 5) meat, poultry, fish, eggs, and dried peas and beans; 6) bread, flour, and cereals; and 7) butter and fortified margarine. Rather than numbers of servings of food groups, this guide suggested alternate choices of food groups in case of limited supplies of certain types of foods during the war. For example, if foods in group 2 (oranges, tomatoes, and grapefruit) were scarce,



the suggestion was to use more from groups 1 (green and yellow vegetables) and 3 (potatoes and other vegetables and fruits).

Following the war, in 1946, the "Basic Seven" was revised and issued in the *National Food Guide* (USDA/ARS, 1946). This food guide suggested numbers of servings of each food group needed daily. The "Basic Seven" was widely used for many years, but its complexity and lack of specificity regarding serving sizes led to the need for modification and simplification.

A new food guide containing four food groups was published as part of *Essentials of an Adequate Diet* by USDA in 1956 (Page & Phipard, 1956). Later the guide was published as a leaflet, *Food for Fitness--A Daily Food Guide* (USDA, 1958). The food guide described in these publications became known as the "Basic Four." It recommended a minimum number of servings from four food groups: two servings of milk and milk products; two servings of meat, fish, poultry, eggs, dry beans and nuts; four servings of fruits and vegetables; and four servings of grain products. The "Basic Four" was developed as a guide to a foundation diet--that is, it was intended to meet only a portion of the calorie needs and a portion (although the major portion) of the Recommended Dietary Allowances for nutrients. It was assumed that individuals would eat more food than the guide recommended in order to satisfy their full calorie and nutrient needs. The Recommended Dietary Allowances for vitamins and minerals were those known in the 1950's. More recent Recommended Dietary Allowances are higher for some nutrients and cover more nutrients. Little guidance was given on the selection of fat and sugars or on appropriate caloric intake. However, the "Basic Four," with its emphasis on getting enough nutrients, remained a focal point of nutrition education for the next two decades.

A new direction for dietary guidance and food guides was set in February 1977 with the issuance of the *Dietary Goals for the United States* by the U.S. Senate Select Committee on Nutrition and Human Needs (U.S. Senate, 1977). The Committee set quantitative goals for intakes of protein, carbohydrate, fat, fatty acids, cholesterol, sugars, and sodium. These goals were the focus of controversy among nutritionists and others concerned with food, nutrition, and health. USDA conducted studies (Peterkin, Kerr, & Shore, 1978; Peterkin, Shore, & Kerr, 1979) to show the types of diets that would meet both the Dietary Goals and the Recommended Dietary Allowances. The diets developed differed considerably from the average food consumption patterns of Americans. One of the most limiting factors

was holding protein levels at no more than 12 percent of calories. Intake for protein, as shown by USDA's food consumption surveys, is about 16 percent of calories (USDA & DHHS, 1989). Because diets to meet the Goals were so different from usual food patterns and because a strong rationale for the protein goal was not apparent, the Goals were not adopted by USDA as the basis for food plans and guides.

However, the Goals drew attention to the need for Federal guidance to the public on diet and health. In 1979, USDA presented the *Hassle-Free Guide to a Better Diet* in a colorful booklet entitled *Food* (USDA/SEA, 1979). The guidance provided in the "Hassle-Free Guide" was similar to the "Basic Four" in that it also described a foundation diet with the same numbers of daily servings for the milk group, the meat group, the fruit and vegetable group, and the grain group. The "Hassle-Free Guide" added to the "Basic Four" a fifth food group--fats, sweets, and alcohol. This food group separated foods that provide mainly calories with few other nutrients from the other four food groups. The "Hassle-Free Guide" was distinctly different from the "Basic Four" because it highlighted the need to moderate the use of fat, sugars, and alcohol and gave special attention to calories and dietary fiber.

In response to the public's desire for authoritative, consistent guidance on diet and health, USDA and the Department of Health and Human Services (DHHS) together issued the first edition of *Nutrition and Your Health: Dietary Guidelines for Americans* in 1980. The Guidelines were based on the most up-to-date information available at the time. They were directed to healthy Americans, not to individuals on special diets for medical reasons. Since 1980, two Federal advisory committees of nutrition experts have been established to review the Dietary Guidelines and to make any recommendations deemed appropriate. Consequently, the Guidelines were revised and reissued in 1985 and 1990 (USDA & DHHS, 1980, 1985, and 1990). The current Dietary Guidelines are--

- Eat a variety of foods.
- Maintain healthy weight.
- Choose a diet low in fat, saturated fat, and cholesterol.
- Choose a diet with plenty of vegetables, fruits, and grain products.
- Use sugars only in moderation.

- Use salt and sodium only in moderation.
- If you drink alcoholic beverages, do so in moderation.

The 1990 Dietary Guidelines incorporated the findings of two major reviews of the scientific literature on diet and health--the *Surgeon General's Report on Nutrition and Health*, published in 1988 by the DHHS, and *Diet and Health: Implications for Reducing Chronic Disease Risk*, published in 1989 by the National Research Council of the National Academy of Sciences. In the 1990 Dietary Guidelines, greater specificity is given to guidance on body weight and intake of fat and saturated fat. In addition, more practical guidance is given on how to implement the Guidelines in daily food choices by including USDA's food guide. Work on development of this new food guide began after the first edition of the Dietary Guidelines for American was issued in 1980.

## II. PHILOSOPHICAL GOALS FOR A NEW FOOD GUIDE

There was a strong conviction that the development process for a new food guide for the public must follow the same sound research process as the development of recommended levels of nutrient intake. Those who develop food guides are obliged (1) to document the purpose of the food guide; that is, the specific goals and objectives that are to be achieved, including both the philosophical goals and nutritional criteria; (2) to conduct research to determine that the nutritional criteria can be achieved by following the guide; and (3) to demonstrate the reliability of the food guide by showing that the objectives can be achieved repeatedly. Without such documentation, the value of a food guide cannot be assessed.

The eight philosophical goals of USDA'S new food guide were based on a study of the evolution of food guides (Light & Cronin, 1981; Wolf & Peterkin, 1984) and on a needs assessment of the professional community conducted through a cooperative agreement with Cornell University in 1983 (Gillespie, 1987). These goals are:

1. The new food guide should promote *overall health* and well-being. Food selection guidance should not be directed to the prevention or treatment of any single disease. Rather, the guide should be consistent with the purpose of the Dietary Guidelines for Americans (USDA & DHHS, 1980, 1985, and 1990), which is to establish the principles of a diet that would help people maintain and even improve their overall health and

reduce the risk of major diet-related diseases. The food guide should be directed to the same audience as the Dietary Guidelines--healthy Americans, 2 years of age and older.

2. The new food guide should be based on *up-to-date* nutrition research on recommended intakes of nutrients and other food components. Approximately three-fourths of nutritionists surveyed in 1983 indicated a desire to replace the "Basic Four" food guide. The criticisms of the "Basic Four" related to failure to assure nutrient adequacy, failure to address current nutritional concerns of excess intake of food components, and failure to communicate effectively. When the "Basic Four" was developed (Page and Phipard, 1956), the system was designed to provide about 80 percent or more of the nine nutrients (protein, vitamins A, C, and D, thiamin, riboflavin, niacin, calcium, and iron) for which there were Recommended Dietary Allowances in 1953. Since then, the RDA for these nutrients have been revised several times and recommended intakes of several other nutrients have been added. When the "Basic Four" was developed, little was known about the role of fiber in the diet or the relationship between high intakes of certain food components and disease.

In addition to being based on current research, information must be presented in a way that is perceived as up to date by consumers. Work done under cooperative agreements with Stanford University (Breitrose & Malin, 1983) and The Pennsylvania State University (Sims & Shepherd, 1985) indicated that the very familiarity of the "Basic Four" negatively influenced its ability to communicate. Consumers regarded the "Basic Four" as old fashioned--something they already knew.

3. The new food guide should focus on the *total diet* rather than a foundation or core diet. In 1983, two-thirds of the nutritionists surveyed indicated that they would prefer a food guide for a total diet rather than a foundation diet.

The "Basic Four" is a foundation diet in that the numbers of servings recommended were a minimum. The "Basic Four" was not intended to cover full calorie and nutrient needs even of the nutrients for which there were recommended levels in 1953. The "Basic Four" assumed that full energy and nutrient needs would be met by additional servings from the four food groups



and from fats and sugars used in cooking or added at the table. However, current dietary recommendations call for limiting intake of calories, fats, sugars, and sodium. A food guide for a total diet must take into account the competing needs for adequate intake of vitamins, minerals, and protein and for avoiding excessive intake of other food components that have been linked to chronic diseases. Assessments of the American diet indicate that intakes of several food components such as iron, calcium, zinc, vitamin B-6, and fiber are lower than recommended for some population groups; whereas intakes of fats, sugars, and sodium are higher, and obesity remains a national problem (USDA & DHHS, 1989).

4. The new food guide must be *useful* to the target audience. It should build on previous food guides. Therefore, food groups should be used as a conceptual framework and these food groups must be recognizable to consumers. Scientists might prefer a grouping system based strictly on nutrients or some other technical characteristic of the food; however, if such grouping systems are not easily recognizable to consumers, they are not useful. For example, tomatoes are botanically a fruit, but consumers use them and think of them as vegetables; therefore, they should be grouped with vegetables. If past food guides have traditionally grouped certain foods together, consumers should not be asked to unlearn this information unless there is a clear advantage to reorganization. For example, food guides have grouped dry beans and peas as meat alternates since 1916. There was no apparent reason to discontinue this. However, use of these nutrient-dense foods could also be encouraged by allowing them to be counted as a serving from the vegetable group. In summary, to be useful to consumers, food groupings should be based on the nutrient content of the food, the way the food is used by consumers, and the way it has been grouped in the past.
5. The new food guide should meet its nutritional goals in a *realistic* manner. To be realistic, demonstrations of the ability of the food guide to meet the nutritional goals should be based on the use of commonly used foods, rather than depending on infrequently consumed foods that are unusually rich in certain nutrients. Nutrient profiles for each food group should reflect food items within the group in the proportions commonly eaten. This should be done to avoid having the nutrient content of infrequently consumed foods unduly influence the nutrient profile assigned to the entire group. For example, oysters are an excellent source of zinc, but because they are a comparatively minor part of the meat, poultry, fish group, they should not be allowed to unduly inflate the average amount of zinc that one might expect to get from this food group. Of course, oysters may be included in a diet that follows the food guide, but one should not expect to get, on average, the amount of zinc provided by oysters by consuming a serving of any item from the meat, poultry, fish group. Although only commonly used foods are included to develop nutrient profiles for the food groups, the food guide is not intended to prohibit selection of any particular food. To the contrary, a new food guide should accommodate all types of foods.
6. The new food guide should allow maximum *flexibility* for consumers to eat in a way that suits their taste and lifestyle while meeting nutritional criteria. The goal of maximum flexibility was one reason to establish nutrient profiles for food groups using foods in their forms that are lowest in fat and that have no added sugars. Once vitamin, mineral, and protein needs are met, theoretically, the balance in calories could be made up by fat and added sugars. Total fat intake is limited by the goal of keeping it below a specified percentage of calorie intake. This approach allows consumers to decide which foods they prefer as sources of fat and added sugars. For example, a new food guide can show consumers how to balance a high-fat dessert such as a rich ice cream with lower fat selections to achieve an overall healthful diet. A food guide that rigidly proscribes certain foods is not likely to be followed consistently.
7. The new food guide should demonstrate a *practical* way to meet nutritional needs. Recommended nutrient and energy needs vary considerably by age, sex, and activity level. One way of addressing these varying needs might be to develop several different food guides. However, consumers often plan and prepare meals for families or other groups of people who have differing nutritional needs. To be most practical, a single food guide should be developed to allow varying nutritional needs to be met by choosing different amounts of foods (numbers of servings) from the same menu.
8. A final goal is that the food guide be *evolutionary*. This means that a new food guide should build on the successful elements of previous guides. To understand the new food guide, consumers should not have to erase

what they already know but rather should build on that information base. To the extent possible, the food guide should be able to accommodate the anticipated direction of dietary recommendations in the future so that radical revision will not be necessary. For example, the ability to tailor more individual diets or to focus on individual nutrients could be accommodated by the formation of subgroups within the major food groups.

### III. RESEARCH TO DEVELOP USDA'S NEW FOOD GUIDE

Once the philosophical goals were established, the research base for the food guide took about 3 years to develop and document. The research was extensively peer-reviewed and use of the new daily food guide was pilot-tested before it was published for the professional community in a USDA administrative report (1985) and in a professional journal for nutrition education (Cronin, Shaw, Krebs-Smith, Marsland, & Light, 1987).

The research documents the philosophical and nutritional goals and the food composition and food consumption data

used. The reports also describe the composition of the food groups; development of their nutrient profiles based on the weighted consumption of foods within each food group and subgroup; and analysis of these data to determine the total quantity to eat from each food group and amounts of total dietary fat and added sugars which may be included to meet the specified nutritional objectives. Menus were also included in the administrative report to demonstrate that the goals could be reliably achieved. The developmental steps were as follows:

**Step 1. Establishment of Nutritional Goals.** The goals for energy, protein, vitamin, and mineral intake were based on the Recommended Dietary Allowances (RDA) established by the National Academy of Sciences (1980, 1989). The goals for other food components such as fat and added sugars were based on the Dietary Guidelines for Americans USDA & DHHS, 1980, 1985, and 1990) and the recommendations of several other authoritative groups (Cronin & Shaw, 1988). Initially, the nutritional goals were based on the 1980 editions of the Dietary Guidelines for Americans and the Recommended Dietary Allowances, but as these were revised, the goals were revised and the food

Table 3. Nutritional Goals for the Food Guide

Nutrient/Food Component	Goals
<b>A. Nutritional adequacy</b>	
Food energy	1,300 to 3,000 calories
Protein	100% of RDA for sex/age groups over 2 years of age
Vitamins: vitamin A, thiamin, riboflavin, niacin, vitamin B-6, vitamin B-12, ascorbic acid, folate, vitamin E	100% of RDA for sex/age groups over 2 years of age
Minerals: calcium, iron, magnesium, phosphorus, zinc, copper	100% of RDA for sex/age groups over 2 years of age
Fiber	Increase consumption
<b>B. Moderation</b>	
Fat, total	30% or less of calories
Saturated fatty acids	<10% of calories
Cholesterol	300 mg or less
Sodium	2,400 mg or less
Added sugars	To balance calories, but not to exceed current consumption

guide was retested to ensure that it continued to meet the specified goals. The current goals for the food guide are shown in table 3.

In developing the nutritional goals, data on the dietary and health status of the population are considered (USDA & DHHS, 1989). Data from USDA's food consumption surveys conducted in 1977-78 (USDA/HNIS, 1984), 1985 (USDA/HNIS, 1985b,c), and 1987-88 (USDA/HNIS, in preparation), and major reports on the health and nutritional status of the population released by the National Academy of Sciences (1989) and the Department of Health and Human Services (1988, 1990), have been used. The purpose of these reviews is to identify those nutrients and food components which may need a special focus in the food guide because intake by the population does not meet recommendations.

The intakes of protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B-12, and phosphorus are generally adequate. On the other hand, intakes of calcium, iron, zinc, magnesium, and vitamin B-6 are frequently low. Of these, intakes of vitamin B-6 and magnesium are less of a concern. Relating vitamin B-6 intake to protein intake rather than the RDA gives a more positive assessment of the adequacy of intake for the population. In addition, actual deficiencies of either vitamin B-6 or magnesium are rare. Although a quantitative goal for fiber was not established, a qualitative goal was established to increase intake of fiber by increasing intake of the foods that provide it--fruits, vegetables, and whole-grain products. The categorization of foods into groups and subgroups was influenced by the desire to focus on foods which would increase intake of calcium, iron, zinc, and fiber while continuing to meet recommendations for the other vitamins and minerals.

Intake by the population is generally higher than recommended for fat, saturated fatty acids, and sodium. Recent surveys have indicated that cholesterol intake on average is close to recommendations. Because the prevalence of obesity in the population is over 25 percent (DHHS, 1990), calorie intake from all sources, but especially from foods that provide few nutrients such as those high in added sugars, is a concern. The new food guide is for the total diet; it is intended to provide guidance related to energy intake that would cover the needs of most people. Therefore the energy goal ranges from 1,300 to 3,000 calories.

A final nutritional goal was to help ensure adequate intakes of nutrients and food components for which RDAs

have not been established or for which food composition data are inadequate. This was to be achieved by recommending consumption of a variety of foods within food groups.

**Step 2. Definition of Food Groups.** While the nutrient content of a food was a primary consideration in the categorization of foods into groups and subgroups, the usual use of a food in meals and how it was grouped in past food guides were also considered. The food groups chosen for the new food guide are similar to the "Basic Four," with familiar sounding names. However, there are a few important differences. The most important difference between the new food guide and the "Basic Four" actually was initiated in 1979 with the release of the "Hassle-Free Guide." This is the separation of foods that are high in fat and added sugars and low in nutrient density from the other food groups (alcoholic beverages are also in this group). This was done to highlight the need to moderate intake of these food components.

Fruits and vegetables were also separated into two groups. In addition to being somewhat different in nutrient content, fruits and vegetables are used differently in meals. It was hoped that separate guidance on these foods would be helpful to consumers in meal planning and would encourage increased use of both fruits and vegetables. However, in presenting the new food guide, particularly when space or time is limited, it may be more practical to discuss fruits and vegetables as one group.

Within the major food groups, subgroups are used to highlight nutrients and food components of concern. For example, two subgroups within the breads, cereals, and grains group were established to place particular emphasis on whole grains. Both enriched and whole grains are important sources of starch, thiamin, riboflavin, niacin, and iron, but whole grains are better sources of folate, vitamin B-6, magnesium, zinc, and fiber. Likewise, five subgroups were established within the vegetable group--dark green, deep yellow, starchy, dry beans and peas, and other. Dark-green leafy vegetables and dry beans and peas were targeted for greater consumption. Subgroups may also be used to differentiate foods within the major groups based on their fat, saturated fatty acids, added sugars, cholesterol, or sodium content.

**Step 3. Assignment of Serving Sizes.** Four factors were considered in establishing serving sizes for the nutrient-bearing food groups. No serving sizes were specified for fats, oils, and sweets because the primary guidance message is to "use sparingly."



*Typical* serving sizes were based generally on median serving sizes as reported in USDA food consumption surveys (Pao, Fleming, Guenther, & Mickle, 1982; Krebs-Smith & Smiciklas-Wright, 1985). For example, these data show that Americans typically consume a half cup of canned, frozen, or chopped fruit or berries; a medium piece of fresh whole fruit; or 6 ounces of juice at one time.

*Ease of use* was also considered. Since a serving size is not a prescribed amount to eat, the serving size chosen was a unit of measure which consumers could easily multiply or divide to represent the amount they actually eat. Common household units (cups, ounces) and easily recognizable units (such as a slice of bread or a medium piece of fruit) were chosen. Serving sizes were expressed in typical household units rather than in grams because household units are more readily recognized and used by consumers. Although different foods within a group may vary in weight and nutrient content for the same household unit, the number of different serving size units for a food group was kept to a minimum to make the guide easier to use.

*Nutrient content* was also an important consideration. For example, serving sizes for the milk, yogurt, and cheese group were specified as amounts approximately equivalent in calcium content to 1 cup of milk (about 300 mg of calcium). Amounts of meat alternates specified--for example, 1/2 cup of cooked dry beans--provide about the same amount of protein and minerals as 1 ounce of meat; and 1/2 cup of cooked vegetables provide about the same amount of nutrients as 1 cup of raw leafy vegetables.

*Tradition* was also considered. In most cases, serving size amounts are similar to those that have been in food guides for many years. Sometimes the serving size used in past food guides and the typical serving size found in recent surveys were not the same. For example, a typical serving reported for the grain group more nearly equates to two slices of bread or 1 cup of pasta. However, traditional serving sizes have been one slice of bread and 1/2 cup of rice or pasta; these units have been widely used in nutrition education materials. There was an additional concern that increasing the serving size from one to two slices of bread would thereby reduce the minimum number of servings from the grain group from six to three. This might give the erroneous impression that, compared to the "Basic Four," the new daily food guide called for a reduction in grain product consumption. In this case, the decision was made to retain one slice of bread as the serving size.

**Step 4. Determination of Nutrient Profiles.** As a preliminary step to determining the number of servings to

recommend for each food group, a nutrient profile was established for each group. These profiles represent the quantities of nutrients and other components that one would expect to obtain on average from a serving of food from each food group and subgroup. Included were food energy, protein, fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, carbohydrate, calcium, iron, magnesium, phosphorus, zinc, vitamin A, thiamin, riboflavin, niacin (preformed), vitamin B-6, vitamin B-12, ascorbic acid, folate, cholesterol, sodium, and potassium. Amounts of added sweeteners were included for foods in the fats, oils, and sweets group. Since the initial work in the early 1980's, dietary fiber, vitamin E, and copper have been included in the nutrient profiles. The food composition data used to develop all the nutrient profiles come from USDA sources (USDA/HNIS, 1990). These data have been updated as new and revised food composition data have become available.

To determine the average nutrient content of a serving of a particular food group or subgroup, the consumption of foods within the group or subgroup was considered. Data from

**Table 4. Food in Grain Composites**

Food	Proportion of Composite
	percent
<b>Whole Grains Composite</b>	
Whole-wheat bread, rolls	42
Ready-to-eat whole-grain cereal	23
Rye bread, rolls	11
Oatmeal, whole-wheat cereal	9
Corn tortilla	7
Crackers, whole-grain	6
Quick breads, whole-grain	1
Brown rice	1
<b>Enriched Grains Composite</b>	
Enriched bread, rolls	48
Ready-to-eat cereal	13
Quick breads, muffins, biscuits	10
Pasta	8
Crackers	7
Rice	7
French/italian bread	4
Farina, grits	2

Table 5.--Nutrient Profiles for Food Group and Subgroup Composites

Food	Amount	Food energy	Protein	Fat	Saturated fat	Monounsat- saturated fat	Polyun- saturated fat	Carbo- hydrate	Iron	Calcium	Mag- nesium	Phos- phorus	Zinc	Copper
		kcal	grams	grams	grams	grams	grams	grams	mg	mg	mg	mg	mg	mg
<b>Fruits</b>	1 serving	69	0.9	0.3	0.1	0	0.1	17.3	15	0.3	15	19	0.12	0.08
<b>Vegetables:</b>														
Dark-green	1 serving	18	1.9	0.2	0	0	0.1	3.3	76	1.4	42	34	0.31	0.11
Deep-yellow	1 serving	40	0.9	0.2	0	0	0.1	9.3	21	0.4	11	27	0.21	0.09
Dry beans and peas	1 serving	115	7.8	0.4	0.1	0.1	0.2	20.7	55	2.6	47	106	1.04	0.22
Other starchy	1 serving	94	2.5	0.3	0	0	0.1	21.3	8	0.6	26	62	0.43	0.19
Other	1 serving	15	0.8	0.2	0	0	0.1	3.2	15	0.4	10	19	0.16	0.05
<b>Meat, Fish, Poultry</b>	1 ounce	57	7.8	2.7	1.0	1.1	0.2	0.1	5	0.6	7	60	1.29	0.04
Egg	1 large	77	6.3	5.3	1.6	2.0	0.7	0.6	25	0.6	5	86	0.52	0.01
<b>Bread, Cereal, Rice, Pasta:</b>														
Whole-grain products	1 serving	72	2.3	0.9	0.2	0.3	0.4	14.2	18	0.7	21	57	0.47	0.08
Enriched grain products	1 serving	83	2.1	1.1	0.3	0.4	0.3	15.9	23	0.8	7	32	0.21	0.04
Milk, skim	1 cup	86	8.4	0.4	0.3	0.1	0	11.9	302	0.1	28	247	0.98	0.03
<b>Fats, Oils, Sweets:</b>														
Fats	1 teaspoon	37	0	4.2	1.3	1.4	1.3	0	0	0	0	0	0	0
Sugar (sucrose)	1 teaspoon	15	0	0	0	0	0	4.0	0	0	0	0	0	0

**Table 5.---Nutrient Profiles for Food Group and Subgroup Composites---continued**

Food	Amount	Vitamin A value	Thiamin	Ribo-flavin	Pre-formed niacin	Vitamin B-6	Vitamin B-12	Ascorbic acid	Folate	Vitamin E	Cholesterol	Sodium	Potassium	Dietary fiber
		mg	mg	mg	mg	mg	µg	mg	µg	mg	mg	mg	mg	grams
<b>Fruit</b>	1 serving	32	0.07	0.05	0.4	0.15	0	33	26	0.4	0	4	256	1.6
<b>Vegetables:</b>														
Dark-green	1 serving	363	0.06	0.13	0.4	0.15	0	24	76	0.8	0	44	213	1.9
Deep-yellow	1 serving	1693	0.05	0.05	0.5	0.15	0	6	13	0.7	0	46	227	2.4
Dry beans and peas	1 serving	0	0.11	0.05	0.3	0.09	0	0	78	0.2	0	224	417	5.3
Other starchy	1 serving	9	0.13	0.04	1.5	0.27	0	12	21	0.1	0	28	361	2.4
Other	1 serving	39	0.04	0.03	0.3	0.05	0	10	24	0.3	0	49	151	1.0
<b>Meat, Fish, Poultry</b>														
Egg	1 ounce	62	0.05	0.09	1.6	0.10	1.09	0	3	0.1	27	39	87	0
	1 large	84	0.03	0.26	0	0.06	0.55	0	22	0.5	213	63	63	0
<b>Bread, Cereal, Rice, Pasta:</b>														
Whole-grain products	1 serving	0	0.08	0.06	0.8	0.04	0.01	0	8	0.2	0	81	59	1.8
Enriched grain products	1 serving	3	0.10	0.07	0.9	0.02	0.01	0	7	0.1	4	106	31	0.6
<b>Milk, skim</b>	1 cup	149	0.09	0.34	0.2	0.10	0.93	2	13	0	4	126	406	0
<b>Fats, Oils, Sweets:</b>														
Fats	1 teaspoon	16	0	0	0	0	0	0	0	0.6	3	16	1	0
Sugar (sucrose)	1 teaspoon	0	0	0	0	0	0	0	0	0	0	0	0	0

USDA food consumption surveys (USDA/HNIS, 1984) and from the U.S. Food Supply series (Welsh & Marston, 1982; Raper & Marston, 1988) were used to determine relative consumption of various foods. As an example, table 4 shows the relative proportion of foods within the two grain subgroups. The nutrient profiles of the subgroups proportionately reflect the nutrient content of the foods within them (table 5). Therefore, the net effect is that the nutrient profile of a food group or subgroup most reflects the nutrient content of the most frequently consumed foods within that group.

In developing the nutrient profiles for the five major nutrient-bearing food groups and their subgroups, foods were included in their lowest fat form, without added sugars. The reason for doing this is based on the philosophical goal of flexibility for the new food guide. The new food guide was to show consumers how to obtain needed nutrients while allowing them maximum flexibility in choosing sources of fat and added sugars within the fat and calorie limits specified. Therefore, the nutrient profile for the milk group includes only skim milk; the meat group includes lean cuts of meat trimmed of all fat and poultry without skin; fruits and vegetables are without added fats or sugars. This approach permitted development of food patterns with the minimum number of servings from each food group that would provide needed protein, vitamins, and minerals. It was expected that consumers would select some food items within the nutrient-bearing food groups that were higher in fat and added sugars--fried chicken, cheese, french fries--and that some additional fats and added sugars would come from the fats, oils, and sweets group--butter, olive oil, soft drinks.

"Nutrient" profiles were also developed for the fats, oils, and sweets group. The fat composite was composed of meat and poultry fat, butter, lard, margarine, other vegetable shortening, and vegetable oils. The fatty acid profile assigned to the composite reflected the relative consumption of these fats by the population (Welsh & Marston, 1982). The added sugars composite originally developed reflected the carbohydrate and calorie content of the various sugars consumed (USDA/HNIS, 1985a). Subsequent evaluations have represented added sugars as teaspoons of sucrose (table sugar). The fats, oils, and sweets group was not considered a significant source of protein, vitamins, or minerals, with the exception of vitamin E.

**Step 5. Determination of the Numbers of Servings.**  
Determination of the amounts of each food group to include

**Table 6. Food Guide Sample Patterns at Three Calorie Levels**

	Pattern A	Pattern B	Pattern C
Approximate kilocalories	1,600	2,200	2,800
Bread Group (servings)	6	9	11
Vegetable Group (servings)	3	4	5
Fruit Group (servings)	2	3	4
Milk Group (servings)	<sup>1</sup> 2-3	<sup>1</sup> 2-3	<sup>1</sup> 2-3
Meat Group (total ounces)	5	6	7
Total fat (grams)	53	73	93
Total added sugars (teaspoons)	6	12	18

<sup>1</sup>Women who are pregnant or breastfeeding, teenagers, and young adults to age 24 need 3 servings.

in the food guide was a two-phase process. The first focused on concerns about nutrient adequacy and the second focused on concerns about moderation. The first phase involved determining the number of servings from each nutrient-bearing food group and subgroup needed to meet the nutritional goals for protein, vitamins, and minerals. Specific Recommended Dietary Allowances (RDAs) for these nutrients vary depending on age, sex, and pregnancy status. Therefore, ranges in the number of servings of the nutrient-bearing food groups were established to cover the full range of nutrient needs. To cover these needs, the new daily food guide recommends 6 to 11 servings of breads, cereals, rice, and pasta; 3 to 5 servings of vegetables; 2 to 4 servings of fruits; 2 to 3 servings of milk, yogurt, and cheese; and 2 to 3 servings (5 to 7 ounces total) of meat, poultry, fish, dry beans and peas, eggs, and nuts.

The greater numbers of servings are for individuals with higher nutrient and calorie needs. Three samples of dietary patterns ranging from the lowest to the highest number of servings are shown in table 6. The quantities of nutrients and the percentage of the RDAs provided by these sample patterns are shown in tables 7 and 8. Three servings from the milk group is recommended to meet the higher calcium needs of women who are pregnant or breastfeeding, teenagers, and young adults to age 24. To meet the lower nutrient and calorie needs of toddlers,



**Table 7. Levels of Nutrients and Other Food Components Provided by the Food Guide--Three Sample Patterns<sup>1</sup>**

	Pattern A	Pattern B	Pattern C
<b>Energy (kilocalories)</b>	1,600	2,200	2,800
<u>Macronutrients</u> (percent of calories)			
Protein	20	17	16
Fat	30	30	30
Saturated fat	9	9	9
Monounsaturated fat	10	10	10
Polyunsaturated fat	8	8	8
Carbohydrate	52	55	55
<u>Minerals</u> (mg)			
Calcium <sup>2</sup>	880	998	1,095
Iron	11.5	15.7	19.2
Magnesium	273	339	399
Phosphorus	1,244	1,464	1,654
Zinc	11.4	13.9	16.1
Potassium	2,780	3,470	4,130
Sodium	1,350	1,830	2,210
Copper	1.1	1.5	1.9
<u>Vitamins</u>			
Vitamin A (RE)	1,973	2,513	3,059
Vitamin E (mg)	7.6	10.6	13.7
Thiamin (mg)	1.3	1.8	2.2
Riboflavin (mg)	1.8	2.2	2.5
Preformed niacin (mg)	15.8	21.3	25.8
Vitamin B-6 (mg)	1.5	2.0	2.4
Vitamin B-12 (µg)	7.2	8.3	9.4
Ascorbic acid (mg)	104	147	191
Folate (µg)	256	342	423
<u>Other components</u>			
Cholesterol (mg)	256	303	348
Fiber (g)	17	22.5	27.5

<sup>1</sup> Sample patterns are shown in table 6.

<sup>2</sup> An additional serving of milk would add the nutrients indicated in table 5, e.g., 302 mg calcium.

smaller servings from all food groups, with the exception of milk, are suggested (table 9). Iron is the main nutrient for which adequacy remains a concern, and only for individuals who have high iron needs (menstruating, pregnant, and lactating women) and who choose the lowest numbers of servings in the food guide ranges. This problem may be addressed by selecting foods high in iron, a fortified breakfast cereal, or through the use of iron supplements, if medically recommended.

Figure 1 shows the contribution of each food group in the 1,600-calorie pattern to selected nutrients, given as a

percentage of the RDA for a woman 25 to 50 years old. The figure illustrates the importance of including all food groups. Choosing a variety of foods from within each food group is also important for obtaining expected levels of vitamins and minerals. This is especially true for the vegetable and grain groups, where certain subgroups have been targeted for increased consumption. The new food guide was designed around the variety of foods currently consumed by most Americans. Vegetarians and others who do not eat foods from one or more of the food groups, such as the meat or milk groups, will need special guidance on

how to meet their nutrient needs. Limiting meat choices to poultry and fish and excluding red meats may result in diets with less than recommended amounts of iron and zinc. Diets in which all meat, poultry, and fish are replaced with equivalent amounts of dry beans and peas and nuts and seeds may be higher than desired in calories and fiber. Because the milk, yogurt, and cheese group furnishes two-thirds to three-quarters of the calcium in the food guide, individuals who do not consume dairy products will need special guidance on meeting their needs for calcium. Further analysis would be needed to ensure that nutrient goals are met before the food guide is adapted for subpopulations with distinctly different eating practices.

The second phase of this step of the research focused on food components for which moderation is a concern. The energy needs of individuals depend on several factors such as age, sex, and activity level. The recommended average energy intake for moderately active individuals over the age of 2 ranges from about 1,300 to almost 3,000 calories per day (National Academy of Sciences, 1989b). If only foods in their lowest fat form with no added sugars were selected from the nutrient-bearing food groups and no foods from the fats, oils, and sweets group were selected, the range in the number of servings from the new food guide would provide 1,220 to 1,990 calories. The difference between the minimum calorie level provided and an individual's calorie needs was used to determine the amounts of fats and added sugars that could be added to the diet within various calorie limits (table 6). The amount of fat was further constrained by the desire to keep total fat below 30 percent of calories.

The initial research done as part of the development of the food guide showed the effects of adding various amounts of fats and sugars (USDA/HNIS, 1985a). This work showed that the percentage of calories from fat could be as low as 18 percent in diets with the minimum number of servings of food low in fat and added sugars from the nutrient-bearing food groups and no added fats or sugars. The amounts of fat and sugars that could be added to bring the diet to almost 3,200 calories with 35 percent of calories from fat were also shown. In the current food guide (USDA/HNIS, 1992), the goal for fat has been set at 30 percent or less of calories (table 7). After subtracting the calories provided by these amounts of total fat (which include the small amounts of fat in the lowfat food group composites), the remaining calories can be provided by added sugars. If less fat is desired, more added sugars could be included.

Table 7 shows the total fat and the fatty acid composition of the three sample patterns. The percentage of calories from saturated fatty acids is 9 percent, which meets the current goal of less than 10 percent. This is based on the assumption that the distribution of fatty acids in the added fat would be similar to the distribution of fatty acids in the current American diet. To get an idea of the potential range in saturated fatty acids, two extremes in dietary patterns were tested. In one, it was assumed that all added fat would be a polyunsaturated oil and margarine made with liquid oil; in the other it was assumed that all added fat would be butterfat. With these assumptions, the percentage of calories from saturated fatty acids would range from about 7 percent to 14-15 percent when total fat is held to 30 percent of calories.

The cholesterol levels shown are dependent on limiting egg yolks to three or four per week (table 7). The sodium levels shown assume no salt added in home preparation. The nutrient profiles do include some sodium added in processing, such as salt added to breads, margarines, and lean cured meats. Limiting cholesterol and sodium consumption to levels recommended by many health authorities (300 mg and 2,400 mg per day, respectively) is more difficult at higher calorie levels because of the greater amounts of foods eaten, particularly baked grain products which may contain egg yolk as well as salt. Consumers can achieve more control over their total fat, saturated fatty acid, cholesterol, sodium, and added sugars intake by becoming familiar with foods that are relatively high or low in these components. Some of this information is provided in guidance materials such as the consumer brochure *The Food Guide Pyramid* (USDA/HNIS, 1992). In the future, food composition data will be readily available on the new nutrient and ingredient lists on food labels.

#### **IV. IMPETUS FOR A NEW FOOD GUIDE GRAPHIC**

The new food guide was first presented to consumers in 1984 as part of a nutrition course developed in cooperation with the American National Red Cross. The course, which consisted of six 2-hour sessions, was extensively evaluated and found effective by its participants, who were adults of various education and income levels. The new food guide also was used in several HNIS publications, including seven short bulletins on each of the Dietary Guidelines, released in 1986 (USDA/HNIS, 1986), and four colorful bulletins on applying the Guidelines in food-related activities, released in 1989 (USDA/HNIS, 1989a, b, c, d). It was featured in an educational outreach program conducted in 1989-1990. This program won the American

**Table 8. Percentages of Recommended Dietary Allowance (RDA) for Specified Sex-Age Groups Provided by the Food Guide--Three Sample Patterns<sup>1</sup>**

Nutrients <sup>2</sup>	Percentage of the RDA Provided											
	Pattern A				Pattern B				Pattern C			
	Child	Child	Female	Female	Child	Female	Male	Male	Female	Male	Female	Male
	4-6 Years Old	7-10 Years Old	25-50 Years Old	51+ Years Old	7-10 Years Old	25-50 Years Old	25-50 Years Old	51+ Years Old	25-50 Years Old	51+ Years Old	25-50 Years Old	25-50 Years Old
Protein	322	276	154	154	338	189	150	150	220	174	220	174
Calcium	110	110	110	110	125	125	125	125	137	137	137	137
Iron	114	114	76	114	157	104	157	157	128	192	128	192
Magnesium	227	161	97	97	199	121	97	97	143	114	143	114
Phosphorus	155	155	155	155	183	183	183	183	207	207	207	207
Zinc	115	115	95	95	139	116	92	92	134	107	134	107
Copper <sup>3</sup>	115	115	77	77	152	101	101	101	123	123	123	123
Vitamin A	395	282	247	247	359	314	251	251	382	306	382	306
Vitamin E	109	109	95	95	152	133	106	106	171	137	171	137
Thiamin	144	130	118	130	178	162	119	149	197	145	197	145
Riboflavin	166	152	140	152	185	170	130	130	195	149	195	149
Preformed niacin <sup>4</sup>	132	122	105	122	163	142	112	112	172	136	172	136
Vitamin B-6	140	110	96	96	141	123	99	99	149	119	149	119
Vitamin B-12	716	512	358	358	592	414	414	414	470	470	470	470
Ascorbic acid	231	231	173	173	327	245	245	245	318	318	318	318
Folate	341	256	142	142	342	190	171	171	235	212	235	212

<sup>1</sup> Sample patterns are shown in table 6.

<sup>2</sup> The Committee on Dietary Allowances recommends a minimum of 2,000 mg for potassium for adults. All examples provide more than this.

<sup>3</sup> Values for copper represent the percentages of minimum safe and adequate intake for age group.

<sup>4</sup> Only preformed niacin and not niacin from tryptophan was included in the nutrient analysis; thus, the values shown for the percentage of RDA for niacin are lower than what is actually available.

**Table 9. Percentages of Recommended Dietary Allowances (RDA) Provided by Food Guide Patterns Modified for Young Children, Teenagers, and Pregnant and Lactating Women**

Nutrient	Percentage of the RDA Provided						
	Sample Pattern A2 <sup>1</sup>		Sample Pattern B <sup>2</sup>			Sample Pattern C <sup>2</sup>	
	Child 1-3 years old	Child 4-6 years old	Female 15-18 years old	Female pregnant	Female pregnant	Female lactating (1st 6 months)	Male 15-18 years old
Protein	356	238	234	171	197	182	200
Calcium	99	99	108	108	116	116	116
Iron	77	77	105	53	64	129	161
Magnesium	251	167	122	115	134	120	107
Phosphorus	124	124	143	143	158	158	158
Zinc	83	83	124	99	114	90	114
Copper <sup>3</sup>	112	79	103	103	125	125	125
Vitamin A	358	286	333	333	401	247	321
Vitamin E	94	81	133	106	137	114	137
Thiamin	132	103	170	125	151	141	151
Riboflavin	181	132	197	160	180	160	160
Preformed niacin	118	88	143	126	153	130	130
Vitamin B-6	109	99	138	94	113	118	124
Vitamin B-12	767	537	461	419	470	397	517
Ascorbic acid	177	157	249	214	276	204	322
Folate	361	241	197	89	109	156	218

<sup>1</sup> Sample pattern A (table 6) modified by reducing all serving sizes by 1/3 except milk.

<sup>2</sup> Sample pattern B or C (table 6) with 3 servings from the milk group.

<sup>3</sup> Values for copper represent percentage of minimum safe and adequate intake for sex-age group.



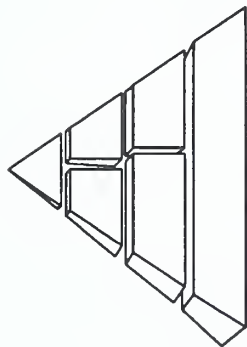
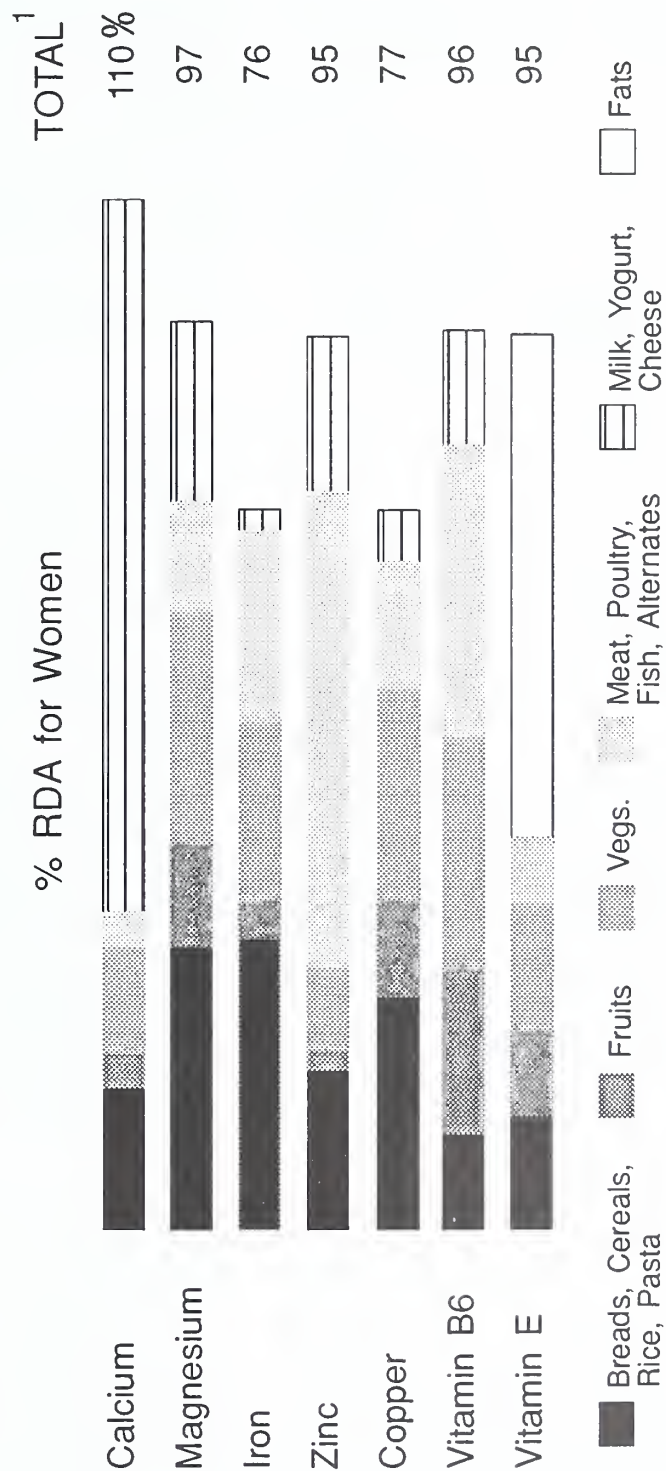


Figure 1. Contribution to Selected Nutrients  
by Food Groups in Pattern A  
(1,600 calories), Women 25-50 Years



<sup>1</sup>Values for food groups may not add to total due to rounding.

Dietetic Association's award for nutrition education in 1991. The new daily food guide was also included in the third edition of the Dietary Guidelines for Americans released by USDA and DHHS in 1990.

Several studies showed the need for food-guide-type information. A study by the University of Wisconsin in 1989 addressed dissemination and effect of the Dietary Guidelines on national, State, and local nutrition professionals. Results supported the need for and the effectiveness of one set of guidelines and one consistent message presented in different ways. Consumer evaluation research conducted at The Pennsylvania State University in 1987-89 on the comprehension and usability of the Dietary Guidelines indicated a need for more information about food groups, serving sizes, and more descriptions on how to follow the Dietary Guidelines (Achterberg, Getty, Pugh, Durrwachter, & Trenkner, 1989; Achterberg, Ozgun, McCoy, & Getty, 1991). Despite the expressed need for food guide information and the various ways the new food guide had been released, the perception remained among many consumers--and even professionals--that USDA was still using the "Basic Four" developed in the 1950's.

In USDA's guidance materials, the food guide had been presented as a chart and called "A Pattern for Daily Food Choices." In the Red Cross course, the food guide was presented as a pie chart, called the "Food Wheel." In the context of the course, the "Food Wheel" was found to be an appealing and effective teaching tool. However, in a study conducted by The Pennsylvania State University in which focus groups of household food managers reviewed a selection of nutrition print materials, the "Food Wheel" graphic was rated as outdated and repetitive of the "Basic Four" information previously learned in school (Sims & Shepherd, 1985). Participants failed to notice that the familiar shape of the circle contained new guidance messages on the moderation of fat and added sugars.

These apparently dissimilar findings may be explained by the results from an earlier study by Stanford University (Breitrose & Malin, 1983). In this study, household food managers reacted negatively to nutrition materials that seemed to focus only on the food groups because they perceived the information to be "old" and already known. Adding information on the fat, sugar, and sodium content of foods to the food group information sparked their interest. In the Red Cross nutrition course, the graphic was seen in the context of the entire course in which considerable attention was given to implementation of all of the Dietary Guidelines, including guidance on

moderation. In The Pennsylvania State University study, participants dismissed the circle shape as "old" without really looking at it.

To bring the new food guide to the attention of consumers, there was need for a new, separate publication explaining the food guide and bearing an appealing illustration that would convey in a memorable way the key messages of the daily food guide--variety, proportion, and moderation.

## **V. COMMUNICATIONS RESEARCH AND GRAPHIC DEVELOPMENT**

### **EARLY RESEARCH**

In 1988, HNIS contracted with Porter Novelli, a market research firm, first to evaluate comprehension and perceived usefulness of the new food guide, and then, based on this evaluation, to develop several graphic presentations of key elements of the food guide. They were to conduct formative evaluations of these graphics with the target audience. Findings from these evaluations would be used to develop and test a publication which would serve as a general teaching tool on the new food guide.

The target audience for the food guide publication was to be the same as for the bulletin that presents the Dietary Guidelines for Americans (USDA & DHHS, 1990); that is, the audience was to be adults with a high school education who were not overly constrained by food cost concerns and who had eating patterns that were typical of the general U.S. population. The key concepts of the food guide to be communicated by the graphic and the accompanying text were to help consumers put the Dietary Guidelines into action (table 10).

### **Phase One**

In the initial phase of the work, four focus groups consisting of men or women 21 to 55 years of age in two east coast cities were used to assess general familiarity with the basic concepts of the food guide. They were shown a chart and text describing the food guide.

In relation to the concept of variety, "food groups" was overwhelmingly familiar. Many participants recalled hearing about food groups in school. Participants demonstrated a general awareness of the concept of a well-balanced diet consisting of a variety of foods. This was related to the benefit of "feeling good" as well as to the long-term health consequences of a poor diet. However, the most salient feature of the participants' approach to nutrition was the division of foods into two categories-

**Table 10. The USDA/DHHS Food Guide Graphic as a Mechanism for Putting the Dietary Guidelines into Action**

Dietary Guidelines for Americans, 1990	Key Concepts of the USDA Food Guide	Graphic Requirements
<ul style="list-style-type: none"> <li>• Eat a variety of foods</li> <li>• Choose a diet with plenty of vegetables, fruits, and grain products</li> <li>• Maintain healthy weight</li> <li>• Choose a diet low in fat, saturated fat, and cholesterol</li> <li>• Use sugars only in moderation</li> <li>• Use salt and sodium only in moderation</li> <li>• If you drink alcoholic beverages, do so in moderation</li> </ul>	<p><b>Variety</b>—Eating a selection of foods of various types which together meet nutritional needs.</p> <p><b>Proportionality</b>—Eating appropriate amounts of various types of foods to meet nutritional needs.</p> <p><b>Moderation</b>—Avoiding too much of food components in the total diet that have been linked to diseases.</p> <p><b>Usability</b>—The food guide must be practical and flexible enough to meet the needs and preferences of healthy Americans over the age of 2.</p>	<p><b>Variety</b>—The graphic must present six categories of food.</p> <p><b>Proportionality</b>—The graphic must present the relative amounts of the various food groups to eat daily and the range in the number of servings to eat within food groups.</p> <p><b>Moderation</b>—The graphic must indicate moderation of fat and added sugars in the total diet. Foods in the fats, oils, and sweets group should be identified as concentrated sources of fat and/or added sugars, but other food group sources should be identified as well.</p> <p><b>Usability</b>—The key concepts listed above must be understandable and memorable.</p>

-"good" vs. "bad." Participants felt bombarded by media coverage of new discoveries which dictate a good food/bad food approach to nutrition.

In relation to proportionality, men in particular noted the relative amounts of the food groups to consume. Women, on the other hand, were more likely to react to the specific numbers of servings. In particular, they expressed concern about grains--"...when you're on a diet, you stay away from breads...."

There was considerable interest in the concept of moderation. In the material that participants saw, no specific limits on fat intake were given, and many participants expressed frustration over the lack of specificity, indicating that this would prevent them from really putting the guidance on fat into action.

Participants also were asked to comment on five different graphic presentations of the food guide (figure 2):

**Circle:** Participants were shown a picture of the "Food Wheel" used by the American National Red Cross. They were very familiar with the pie chart design. Although they easily understood this graphic, the very familiarity of

the shape had a negative effect, resulting in perceptions of it as unimaginative, old-fashioned, or providing information they already knew.

**Blocks in a row:** Participants were shown a graphic with the minimum number of servings for the nutrient-bearing food groups depicted as blocks stacked in a row. It was called "2-3-6 A Day." Those who liked it mentioned ease in remembering the number of servings as the reason. Those who did not like it mentioned the unbalanced design or the limited amount of information conveyed--the range in the number of servings for food groups and the fats, oils, and sweets group were not shown. In general, this graphic did not elicit strong feelings.

**Blocks in a circle:** This design was similar to that described above except that the blocks depicting the minimum number of servings in a group formed a circle. Compared to the other block design, the single geometric shape of the circle of blocks did a better job of depicting the total diet concept. However, this graphic was almost universally disliked--"too hard on your eyes."



*Inverted pyramid (funnel):* This design showed grains at the top, wide band of the inverted pyramid; and fats, oils, and sweets at the bottom tip. Participants' reactions were very polarized. However, most disliked it; they found it unsettling and off-balance. For these people, the awkwardness of the design was so distracting that it interfered with the message.

*Pyramid:* This design showed grains at the bottom and fats, oils, and sweets at the tip. Participants found this design very appealing. Proportionality was easily conveyed. Grains at the base suggested "a good foundation." Comments indicated that the goal of usability could be achieved. The design was considered "easy to memorize"; several participants felt that they would be able to use the information without carrying around a physical reminder. The design shown to participants did not include pictures of food; several participants commented that this would be a good addition.

As a result of these focus groups, the two block designs were rejected primarily because they conveyed less information than the other designs without any other advantages. The circle of blocks was the least liked of all the designs. The inverted pyramid was rejected primarily because of concern that the shape was so distracting that it would interfere with the message. The circle was rejected primarily because of concern that it could not be changed sufficiently to make the message seem new and interesting. The pyramid appeared to work well. The design seemed novel and "adult" and the key messages seemed to be conveyed clearly and memorably.

## Phase Two

In the second phase of the work, a brochure featuring the pyramid was designed using text developed by USDA staff. During the fall of 1990, the brochure was formatively evaluated to identify confusing or missing information in the text and to test several variations of the pyramid graphic. Five focus groups of adult men or women were conducted.

One focus group consisted of participants 21 to 35 years of age, three groups were 36 to 55 years of age, and one group was 56 years of age and older. The depth of knowledge of nutrition varied somewhat among younger and older women, with older women appearing more knowledgeable about specific nutritional information that may relate to the health concerns of older Americans. Otherwise, few reactions to the materials presented varied on the basis of age or sex.

In general, the focus of the brochure on healthful eating was understood and participants were positive about its purpose--all participants wanted to keep their copy of the brochure. However, several participants thought the brochure was too long and repetitious and in several instances, the material was not organized as they thought it should be. As a result, the sections were reorganized. For example, information on fat and serving sizes was moved forward and because alcohol raised such controversy, discussion of it was deemphasized.

As indicated in the first phase of the research, the pyramid shape appeared to easily convey the concept of variety. The participants clearly understood that guidance was being given on selecting foods from various food groups. Some participants disagreed with the number of food groups shown in the graphic. Several participants said they found themselves combining fruits and vegetables into one group to make the total number work out to the "four" major food groups, but then they did not know what to make of the fats, oils, and sweets group. Some participants wanted to eliminate it--"Let the pyramid be 100 percent positive." However, eliminating this group would violate an early decision that the food guide is for the total diet.

Proportionality appeared to be conveyed. Participants considered the pyramid illustration to clearly present the relative numbers of servings suggested for each food group. "One thing this pyramid idea gives you, as opposed to the 'Basic Four,' is trying to remember how many servings of each--you look at it, and you know you are supposed to eat more of the bread and cereal and less of the dairy. Plus, the symbols show you where the fat is."

Overall, participants understood that the sizes of the sections of the pyramid were intended to convey the relative amounts to eat of the various food groups. "The bulk of the pyramid is things that are good for you and the little top is things you should avoid."

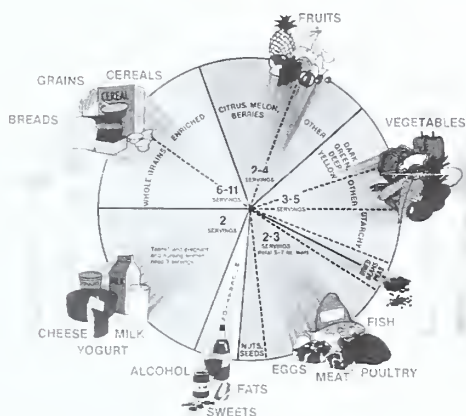
Most agreed that the meaning of the pyramid shape could be easily understood by any audience. "Less-educated people are not going to understand a table that's got all these lines, they're not even going to bother with it. This [the pyramid graphic] is concrete, this is right in front of you. Most people can understand it."

Participants were most interested in the concept of moderation. They liked having the guidance on limiting fat put into specific numbers of grams. The message to communicate was moderation of fat and added sugar in the total diet. During development of the new food guide

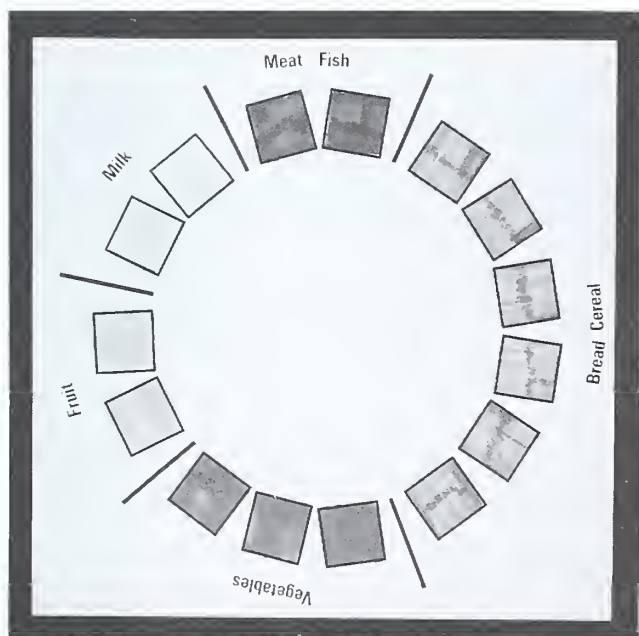
Figure 2. Graphic Designs Tested in Exploratory Focus Groups

**FOOD WHEEL**

A Pattern for Daily Food Choices

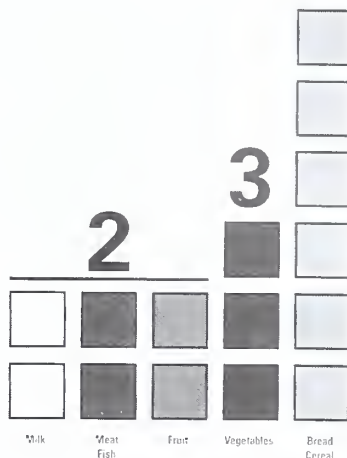


**Circle**

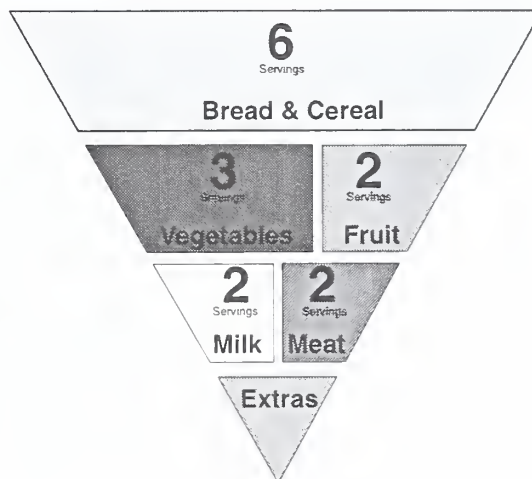


**Blocks in a Circle**

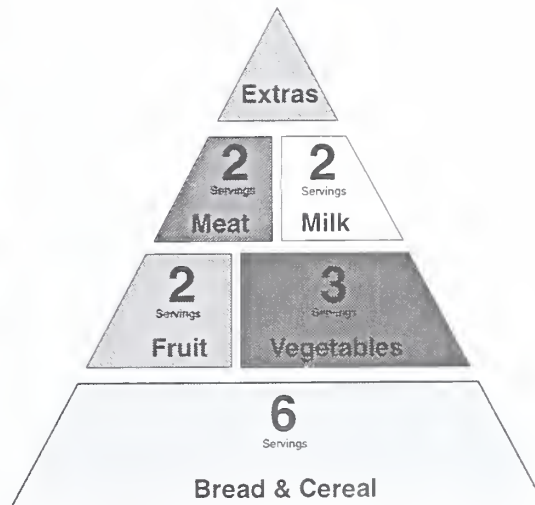
**6 A DAY**



**Blocks in a Row**



**Inverted Pyramid (Funnel)**



**Pyramid**

graphic, researchers recognized that it would be difficult to communicate both the concept that fat and sugars are food components--chemical compounds--which can be part of foods in several food groups and the concept that fats, oils, and sweets are a separate food group high in fat and added sugars. The fat and added sugars symbols concentrated in the tip and sprinkled throughout the rest of the food groups were intended to show that foods in the fats, oils, and sweets group are concentrated sources of these chemical compounds and that foods in other food groups can also be sources. The intent was for consumers to see two ways to moderate fat and added sugars in their total diet: (1) moderation of foods in the fats, oils, and sweets group (conveyed by the small size of the pyramid tip and the concentration of fat and added sugars symbols) and (2) moderation of food selections high in fat and added sugars within the other food groups (conveyed by the symbols throughout the food groups).

The use of both pictures of fats, oils, and sweets and of symbols to represent the chemical compounds of fat and sugar resulted in a cluttered design. A decision had to be made. If the food pictures were used, moderation of foods in the tip might be more clear, but the fat and added sugars symbols had to be deleted, thereby removing the opportunity for communicating that many other foods can also be sources of fat and added sugars.

The effect of pictures of high-fat and high-sugar foods versus symbols for fat and added sugars was assessed with the target audience. There was considerable debate among participants about the issue. Some participants did not understand the meaning of the symbols. Some were confused by foods high in fat and foods high in added sugars being in the same group or they were uncertain as to why fat symbols should be in the vegetable group. Initially, participants liked the idea of food pictures in the tip, but after they understood the meaning of the fat and sugar symbols, most agreed that the food pictures were unnecessary. Some participants indicated that since "fats, oils, and sweets" was a "negative food group," examples should not be given. Ultimately, most participants agreed that the omission of the fat and added sugars symbols did not convey the same message as their inclusion. That is, the fat and added sugars symbols graphically indicated presence of fat and added sugar in the other food groups, which the food pictures alone did not.

After reading the brochure, most participants liked the concept suggested by the fat and added sugars symbols. The explanation in the brochure was considered to be very informative and educational by many participants. "The

one thing it did, which I thought was interesting, was that I don't think we are aware of the oil and the sugar and the fats that are already in the foods, so that we don't have to add to it...I think it's important because I don't think people realize how much is already in their foods. You get your fat automatically."

Although it was clearly advantageous to be able to communicate the more complete moderation message through the use of the fat and added sugars symbols, the concern remained about consumers who might see the graphic without the accompanying text. Would the message of the symbols just be missed? Or would the presence of the symbols be so distracting that the broad message of moderation might be overlooked? From the comments of several of the participants, it appeared that those who did not understand the symbols were not distracted by them. Those who had initially misunderstood the meaning of the symbols from the graphic alone indicated that the explanation in the brochure provided the needed clarification. "[The explanation] made me realize what those fat and sugar symbols were. I didn't think about it when I first saw the pyramid. But having read this I went back and I realized what it was talking about." "When I first looked at the pyramid, I just didn't understand about the symbols. But after reading this, it broke it down."

The selection of foods to be illustrated in the pyramid tip was a subject of debate among the participants, whereas food pictures for the other food groups were not. Many participants disagreed with the foods chosen to illustrate the fats, oils, and sweets group--soda can, syrup bottle, and salad dressing bottle. Replacement food choices suggested included a candy bar, stick of butter, and a chocolate drop.

Two different color backgrounds were also considered--black versus blue. A black background was preferred by three of the five focus groups. Most participants agreed that the black provided more of a contrast to the color of the food pictures. "[Black provides] more of a contrast against the color of the foods. There are no black foods, either. Some of the foods have blue in them. They kind of blend into the [blue] background."

### Phase Three

In the third phase of the work, further testing was done to ensure that the pyramid graphic would convey the key messages when seen without accompanying text. It was not expected that all consumers seeing the pyramid graphic without accompanying text would understand the meaning of the fat and added sugars symbols. Alternative



designs for the cover of the brochure were also tested. Sixty women, 30 to 75 years of age, were interviewed in an east coast shopping center using a series of open-ended and rating questions. To assess the first impression created by the graphic, participants were asked to look at the graphic and comment on what it attempts to communicate. Most responded with comments related to the variety and proportionality messages (57 percent); some commented on the overall purpose of healthful eating (27 percent). When asked specifically about confusing information, almost all of the participants (51 out of 60) said they found nothing confusing in the graphic.

To assess the ability of the graphic to convey the primary food guide messages of variety, proportionality, and moderation, participants were asked to rate their level of agreement or disagreement with related statements. As reported by the participants, the pyramid graphic without accompanying text communicated the key concepts (table 11). However, it was questioned whether respondents really understood the meaning of the fat and added sugars symbols. Therefore, they were asked specifically the meaning of the fat symbols in the vegetable group. Only a quarter of the respondents correctly stated the symbols indicated that fat can be added to vegetables. Almost half of the respondents incorrectly stated that the symbols meant that vegetables contain fat. Some respondents indicated they were confused because vegetables are not high in fat.

## Results

The conclusion was that the graphic communicated most of the intended messages--even without accompanying text--to the targeted audience. The results indicated that although the meaning of the fat and added sugar symbols was not likely to be clear to everyone without accompanying text, the symbols were not distracting. While these results were reassuring, the intent at that time was to use the graphic with accompanying text appropriate to the target audience.

During the development process, the draft text of the consumer booklet describing the food guide and pyramid sketches were peer-reviewed by nutrition educators in other Federal agencies, universities, State Extension offices, and health organizations. The draft bulletin was also reviewed for consistency with the Dietary Guidelines by USDA's Dietary Guidance Working Group (representing nine USDA agencies and a liaison from DHHS).

When Edward Madigan became Secretary of USDA in March 1991, he requested that the Department target its

nutrition education endeavors to reach those most at nutritional risk--children, low-literate and low-income adults--those who are the beneficiaries of USDA's food assistance programs. He delayed the release of the pyramid graphic for additional research and testing with these groups to make sure that the Department's efforts would indeed relate to those most in need of nutritional guidance.

## FINAL GRAPHIC RESEARCH

In July 1991, Bell Associates, Inc. (BAI), of Cambridge, Massachusetts, was retained by USDA's Office of the Assistant Secretary for Food and Consumer Services, in collaboration with the Department of Health and Human Services, to conduct further research on graphics for presenting the USDA food guide. They were to develop and test graphic alternatives to the food guide pyramid for conveying the key concepts of the food guide (table 10). There was particular interest that the graphic not convey misinformation, especially to children, consumers with less than a high-school education, and low-income people. An advisory panel provided advice to the contractor on the research study design and on development of the graphic materials. The panel included members from the fields of nutrition education, cognitive psychology, education, market research, communications research, evaluation design, and statistics. An Internal Technical Working Group, which included designated staff of both USDA and DHHS, also provided recommendations and reactions.

The work was divided into two broad phases--qualitative and quantitative. In the qualitative research phase, many graphic alternatives were evaluated and refined. Based on these results, final graphic alternatives were selected for testing in the quantitative research phase. In this phase, a structured questionnaire was administered to a large number of respondents to measure the relative ability of the graphics to communicate the key food guide messages with a minimum of misinformation.

## Qualitative Research

In the qualitative phase of the work, 26 focus groups were conducted. Twelve groups were with a total of 84 children in grades 5, 8, and 11. Boys and girls were kept separate, and the racial and ethnic mix of the groups was intended to reflect that of the school from which the children were selected. Eleven focus groups were conducted with 67 low-income adults. All adults were enrolled in either the Food Stamp Program or in the Special Supplemental Food Program for Women, Infants, and Children (WIC). Black, white, and Hispanic men and women in two age groups--21

to 44 years and 45 to 70 years--were represented. Three sites were chosen for the focus groups--Boston, MA; Albuquerque, NM; and Memphis, TN. Three special focus groups were also conducted--one with nine elementary and secondary school teachers of science and home economics; one with ten food industry representatives associated with various commodity groups; and one with ten representatives of several professional associations and advocacy groups. One-on-one structured interviews were also conducted. Twenty-one of the interviews were with children in grades 5, 8, and 11, and 21 were with adult participants in the Food Stamp Program.

USDA's Design Division in the Office of Public Affairs developed an initial set of six graphics based on review of previously tested designs and review of about 400 designs that had been sent to the *USA Today* newspaper as a result of a solicitation for reader suggestions for revising the original food guide pyramid graphic. This set included (1) the original food guide pyramid design, (2) a right triangle divided into five sections with a horizontal strip along the bottom showing fats, oils, and sweets, (3) a pie chart, (4) a pie chart depicted as a plate with a fork and knife at the sides, (5) a set of six building blocks and (6) a bar graph in which each bar was topped with a rocket. The latter two designs were dropped and further design work was done by Melanson Associates of Boston. Several of these are shown in figure 3.

Initially, a right triangle and quarter circle were reviewed, but they were eliminated because it was impossible to make the milk group and the meat group the same size. A fan and a window design were also eliminated because it was difficult to see the sizes of the sections and therefore difficult to communicate proportionality. These designs also were less appealing than others to the focus groups.

Several variations of pie charts were tried. The pie charts tested differed from the previous "Food Wheel" in that the circle was divided into five parts with fats, oils, and sweets outside the circle. In a variation referred to as a "picnic design," each food group was in a separate circle. A square tabletop-like shape was added as background to unify the circles; however, there was confusion about the role and meaning of the tabletop background. The relative proportions of the various food groups were difficult to see in the pie charts and the picnic graphic was often incorrectly interpreted as representing a single meal. The message of moderation of fats, oils, and sweets was not understood.

Although some participants liked the circles, many did not. Teachers thought the circle and the pyramid would be a good teaching tool. Although some in the food industry group thought the circles were too busy, they liked the fact that they did not "stack" food groups. Children sometimes saw the pie chart as pizza. As had been shown in earlier work, the material in a circle format was perceived to be "old." Ultimately the circles were eliminated because of the concern that audiences seeing a circle graphic would not examine it closely enough to see that it did contain new information.

Several grocery cart graphics were tested because of their obvious food-related significance. In contrast to the risk of a pie chart or a picnic design being interpreted as symbolically presenting the recommendations for a single meal, a grocery cart could more reasonably be interpreted as representing food for a day or a longer period.

Several variations of the inside shapes of the grocery carts were tried. One was divided like a bar graph and others were divided irregularly, like jigsaw puzzles. However, it was more difficult to determine the size of the sections in the jigsaw design. Another design represented the interior sections of the grocery cart as grocery bags of different sizes. Most respondents in the focus groups and one-on-one interviews did not immediately recognize the shapes as bags, and many reacted negatively to the colors used even though these were revised several times. Although some respondents liked the grocery cart design, others expressed negative reactions to shopping for groceries, or stated that they did not load their carts as the illustrations showed. Most children did not relate to the grocery carts. All of the grocery cart graphics were finally eliminated at the focus group stage because they were ambiguous and somewhat controversial.

More than 10 variations on a bowl design were tested. For example, the interior design was varied: horizontal divisions with the grain group at the top or the bottom; or vertical divisions with grains in the middle or at the side. The background color and symbols for fats, oils, and sweets were also varied. Participants did not like the bowls with the horizontal divisions. The relative differences in the size of the sections were difficult to see and proportionality was not well conveyed. The vertically divided bowls tested well. Of all the shapes, adults rated these highest. They seemed to like the realism of the bowl shape. Although the food industry group did not think it conveyed proportionality well, they liked the vertically divided bowl because it did



**Table 11. Initial Research on Ability of the Pyramid Graphic to Convey Key Concepts**

	Percent of participants agreeing (N=60)
<b>Related to Variety</b>	
The pyramid clearly shows the food groups.	97
<b>Related to Proportionality</b>	
The shape of the pyramid shows that you should eat more of the foods at the bottom and less of the foods at the top.	85
The number of servings information is helpful.	78
<b>Related to Moderation</b>	
The fat symbols mean natural and added fat.	82
The fat and sugar symbols show that fat and sugars can be part of the fats, oils and sweets category and foods from other groups.	78
<b>Related to Usability</b>	
The illustration was informative.	93
This information is useful to me.	85
If the graphic were part of a larger brochure, I'd be interested in reading it.	78

Porter Novelli, 1990

not "stack" foods. They also liked fats, oils, and sweets at the bottom of the bowl. Because the vertically divided bowls tested well in all aspects of preference and message transmission, variations of this shape were moved forward for quantitative evaluation.

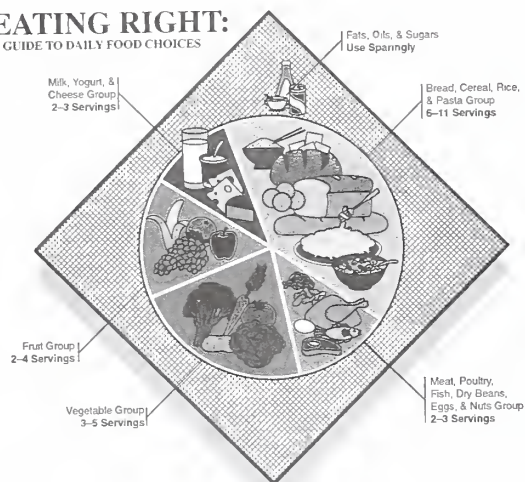
Two pyramid designs developed by Porter Novelli--one with pictures of fats, oils, and sweets in the tip, and one with symbols of fats and sugars throughout--were tested with the focus groups along with a variation that had a multicolored background. These designs tested well in all aspects of message transmission and preference so they also were brought forward for quantitative testing. The food industry group was concerned about the hierarchical implications of being at the top of the pyramid and alternately of foods near the top being considered "bad"--guilt by association. Teachers, children, and advocates rated the pyramid highest. They thought it contemporary. Teachers believed the pyramid would be the most effective teaching tool, especially at communicating proportionality. Children seemed to learn the most from the pyramid.

In summary, the various types of focus groups evaluated the effectiveness of the graphics somewhat differently. The pyramid was rated highest by the focus groups of children

and teachers and the professional association/advocacy group. The children liked the pyramid shape with a black background and with symbols for fat and added sugars best. They selected the other two pyramid designs next. They liked the brightness of the design with the black background best. Teachers selected the pyramid with the fat and added sugars symbols with either a black or colored background as the best teaching tool, and indeed the children did seem to gain the most information from these designs. The teachers also thought that the pie chart would be an effective teaching tool, but they rated it lower than the pyramid designs. The professional association/advocacy group also rated the pyramid shape highest, but they thought the meaning of the fat and added sugars symbols would be too difficult to understand and recommended using the pictures of fats, oils, and sweets. On the other hand, the bowl with a multicolored background and pictures of fats, oils, and sweets was rated higher by the low-income-adult focus groups. The pyramid designs with a black background were their next choices. The food industry respondents rated the pie chart highest followed by the bowl with pictures of fats, oils, and sweets.

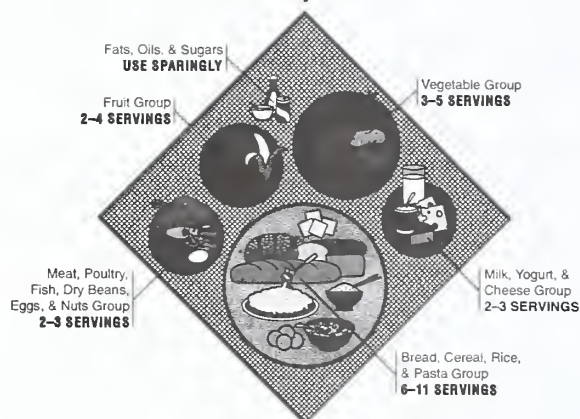
**Figure 3. Selected Initial Graphic Alternatives  
Tested in Qualitative Phase**

**EATING RIGHT:  
A GUIDE TO DAILY FOOD CHOICES**



**Eating Right:**

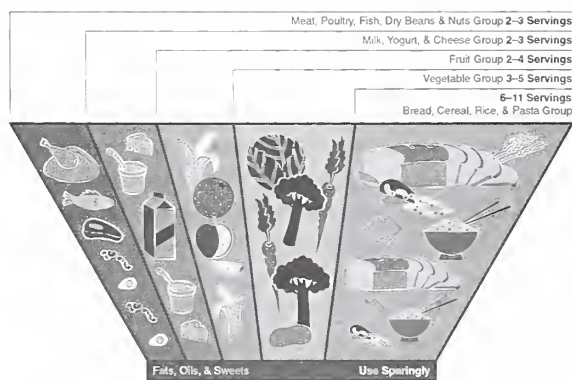
A Guide to Daily Food Choices



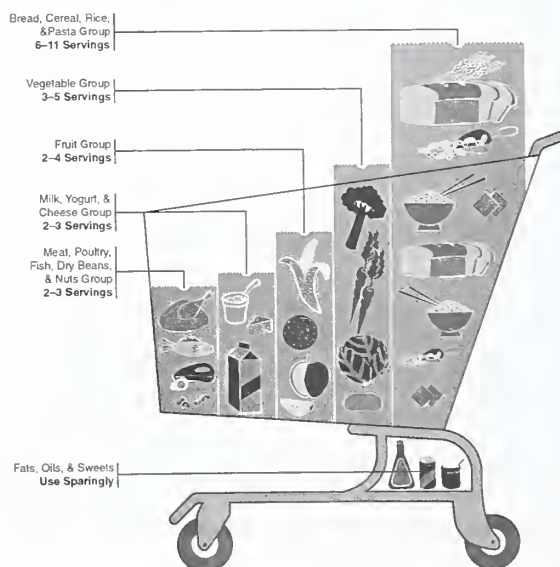
**EATING RIGHT:  
A GUIDE TO DAILY FOOD CHOICES**



**EATING RIGHT A GUIDE TO DAILY FOOD CHOICES**



**Eating Right:  
A Guide to Daily Food Choices**



**EATING RIGHT: A GUIDE TO DAILY FOOD CHOICES**



In the one-on-one interviews, respondents were shown four graphic shapes--pyramid, bowl, grocery cart, and circle (pie chart or picnic design) with variations in background color and in the use of pictures of fats, oils, and sweets versus fat and added sugars symbols. They were asked to rate the graphics and to select the ones they liked best and least. Thirty-seven percent of respondents selected bowls as their favorite graphic (regardless of color), food pictures versus fat and added sugars symbols, or internal divisions (vertical or horizontal). Unpopular shapes included the pie chart (least-liked by 37 percent) and shopping carts (least-liked by 36 percent). The black pyramid with fat and added sugars symbols was the first choice of 36 percent of the respondents who saw it. Overall, however, the pyramid shapes were chosen as most- and least-liked equally often, by 27 percent of respondents who saw them. Thirty-seven percent of respondents chose a graphic with a black background as their favorite, and 36 percent of respondents chose a grocery cart with a tan background as their least favorite. The 24 respondents who disliked the grocery cart cited shape and color equally as reasons. Based on direct questioning, most respondents did not notice the fat and added sugars message in any of the graphics. Overall, it was determined that respondents were somewhat more likely to understand the fats message when it was represented by symbols and a key than by food pictures.

Before the quantitative testing began, the pictures of food used for the pyramid and bowl designs were further refined. These changes were based on the comments and recommendations of the participants and the advisory groups. For example, the scoop of elbow macaroni in the breads and cereals group was replaced by a plate of spaghetti. The purple cabbage was replaced with green cabbage. (However, the cabbage was occasionally interpreted as lettuce.) Peanuts were added to illustrations of the meat group. The wheat stalk was eliminated from the breads and cereals group and whole-grain products were added. The milk carton was replaced with a glass of milk; the apple wedge was replaced with a whole apple. The pictures of fats, oils, and sweets were changed from salad dressing, soda, and a sugar bowl to a spoonful of sugar, a stick of butter, and a droplet of oil; however, later testing suggested that these pictures were still subject to misinterpretation. The oil droplet, for example, was mistaken as a drop of honey by some, the stick of butter was seen as cheese, and the spoonful of sugar was seen as a spoon of fat, grease, or flour. The idea of illustrating single servings of food was considered because of the widespread confusion about what constitutes a serving size, but this concept was abandoned

because of the difficulty of illustrating recognizable single servings of foods.

The use of various background colors was also considered. Many respondents liked the black background for both the pyramid and bowl designs, and some liked a multicolored background. Various neutral shades of brown, tan, taupe, gray, and blue were tested, but were not well liked. Some early graphics tested the mnemonic device of correlating background color with the type of food (e.g., green for vegetables). Respondents who noticed this device liked it, but those who did not notice it complained of the lack of contrast between the foods and their backgrounds.

### Quantitative Research

The quantitative phase of the research was designed to measure the relative ability of the graphics to communicate the key concepts of the food guide. A total of 3,017 individuals were interviewed at five sites--Fort Lauderdale, FL, and Boise, ID, in addition to the three sites used for the focus groups. For analytical purposes, the sample population was grouped by education level, gender, and ethnicity; also, adults were grouped by household income and children were grouped by whether or not they received free or reduced-priced school lunches (table 12).

The graphics tested varied on three primary dimensions: (1) shape; (2) symbols versus pictures; and (3) background color. The two shapes--pyramid versus bowl (figure 4); fat and sugar presentation--fat and added sugars symbols versus pictures of fats, oils and sweets; and two background colors--black versus multicolored--were completely crossed, resulting in eight graphics. Two additional graphics were tested (one bowl and one pyramid with black backgrounds) in which the symbols representing added sugars were eliminated, leaving only the symbols for fat.

The test instrument was a structured questionnaire consisting of 60 questions in three sections. In the first section, respondents were asked to comment, without prompting, on their first impressions of the various graphics. The second part of the interview, the prompted response section, consisted of questions designed to establish which graphics were better able to convey the key concepts and which features of the graphics (e.g., text, section size) conveyed that information. Misinformation also was assessed. The final section of the questionnaire consisted of a comparison of the tested graphic with an alternative shape (different shape but identical use of

symbols or pictures, and background color). Respondents were asked which shape they thought better conveyed messages regarding the daily variety of foods to be eaten and moderation of fat intake. They also were asked which graphic shape they liked best.

Responses to the questionnaire were used to assess the relative ability of the graphics to communicate the key concepts of variety, proportionality, and moderation. Under these key concepts, several subconcepts were defined, reflecting important aspects of the key concept which could be communicated by specific features of the graphic. A score for each subconcept was developed by reviewing the 60-item questionnaire and the more than 250 possible responses. In developing a score, questions and answers that were considered the best indicators of communication effectiveness were given the most weight and those which presented problems in terms of interpretation were downweighted or dropped. Within the key concepts, more important subconcepts were weighted more heavily. For example, in the moderation concept, the subconcepts of "limit total fat" and "food sources of fat" were weighted four times more than the corresponding subconcepts concerning added sugars, because of the greater importance of limiting fat from a public health standpoint. Table 13 lists the subconcepts and their weighted values within each key concept. A scoring system also was developed to assess the potential of the graphic to convey misinformation. In particular, attention was given to potential misinformation that might be communicated by the graphic shape.

Analysis of the scores involved two procedures: (1) analysis of variance (ANOVA) for those scores created through combinations of questions resulting in multiple possible outcome scores; and (2) logistic regression (LOGIT) analysis for those measures restricted to only two possible outcomes. LOGIT was employed for the binary misinformation subscores, shape inversion, icon counting, and text leading to wrong answers. ANOVA was employed for the remaining concept scores. The concept scores for the entire sample are displayed in table 14 and the results for various sample subgroups are summarized in table 15. For simplicity, scores for the two graphics tested without added sugars symbols are not shown and scores for graphics differing only in background color were combined. Table 16 shows concept scores for the pyramid and bowl graphic by educational level.

## Results

**Shape:** By far, the most important characteristic examined was that of shape. For the sample population as a whole, the differences between the pyramid and the bowl in communicating the proportionality and moderation concepts were large and highly significant ( $p < .001$ ). Higher scores for the pyramid were consistent across all the subpopulations examined, including those for whom concern was greatest--children and individuals on food assistance programs. As might be expected, the recognition of the proportionality and moderation concepts in either the pyramid or the bowl increased with education, being highest for grades 8 through 10 and for adults with at least a high school education. The correlation between these concepts and education was statistically significant. Higher scores were associated with the pyramid except for grades 2 and 3, who had consistently low scores for both pyramids and bowls.

Three subconcepts were assessed under the proportionality concept and four under the moderation concept. Scores were higher for the pyramid than for the bowl for the four moderation subconcepts and for two of the proportionality subconcepts. Daily frequency was the exception. This was a measure of respondents' recognition that the number of servings shown in the graphics were to be eaten daily. However, this concept was given little weight in the calculation of the overall concept of proportionality because it was considered less important to the understanding of proportionality than the subconcepts of understanding the relative amounts or the suggested numbers of servings from food groups.

The most easily conveyed concept was that of *variety*. This was indicated by the generally high scores for the variety concept and by the lack of correlation between the variety scores and education level. Even the respondents in grades 2 and 3 had high scores on this concept. However, the measurement of the variety concept was somewhat limited compared to the others--only one question asked respondents to name the food groups.

The scores were slightly higher for the bowl than for the pyramid for the sample population as a whole ( $p < .05$ ). In general, differences were not significant for the population subgroups examined.

The assessment of *misinformation* indicated that the pyramid communicated significantly less misinformation than the bowl ( $p < .01$ ) (table 15). One of the most important subconcepts tested was shape inversion--believing foods at

**Table 12. Graphics Research--Quantitative Phase--Sample<sup>1</sup> Characteristics**

	Number	Percent
<b>Gender</b>		
Female	1,690	56.0
Male	1,315	43.6
Missing	12	0.4
<b>Ethnicity</b>		
Black	875	29.2
Hispanic	580	19.3
White	1,368	45.6
Other	180	6.4
<b>Education</b>		
Children		
Grade 2-3	483	16.0
Grade 4-5	90	16.2
Grade 6-7	479	15.9
Grade 8-10	471	15.6
Adults		
Less than high school	516	17.1
High school or more	574	19.0
Missing	4	0.1
<b>Household Income</b>		
Adults Only		
Under \$8,616	391	35.9
\$8,617-\$17,424	337	30.9
\$17,425 and over	319	29.3
Missing	47	4.3
<b>School Lunch Participation</b>		
Free/Reduced	84	35.6
Paid	1,002	52.1
Missing	237	12.3

Bell Associates, Inc., 1992

<sup>1</sup> Total number in sample is 3,017.

the top of the pyramid or at the sides of the bowl are "better." Concerns had been expressed earlier that the pyramid shape might give this impression. However, no significant differences were found between the pyramid and the bowl.

On the other hand, some concerns were also raised about the shape of the bowl interfering with the moderation message. It was suspected that the base of the bowl might be viewed as more a part of the artistic representation of a bowl than as the part of the graphic intended to convey the moderation of fats, oils, and sweets message. The results indicated a highly significant difference between the pyramid and the bowl ( $p < .001$ ). More respondents failed to attribute significance to the base of the bowl and missed

the moderation message. In fact, many thought the bowl graphic indicated they should eat the least from the meat and milk groups.

Two other subconcepts of less concern were tested--icon counting, which was the incorrect impression that the number of foods pictured in a food group indicated the recommended number of servings; and incorrect interpretation of the text. Respondents who viewed pyramid graphics were somewhat more likely to report counting food pictures to determine amounts to eat. The reason for this finding is not clear. No significant relationships between incorrect interpretation of the text and graphic characteristics were observed.



**Symbols versus pictures:** The use of fat and added sugar symbols versus pictures of fats, oils, and sweets affected primarily the scores for the moderation and proportionality concepts. Prior to testing, considerable concern had been expressed about the complexity of communicating moderation of fat and added sugars in the total diet through (1) sparing use of foods traditionally thought of as sources of fat and added sugars (shown by the small tip of the pyramid or the base of the bowl) and (2) less frequent selection of foods higher in fat and/or added sugars within each nutrient-bearing food group (shown by the symbols). The first message might be strengthened by the use of pictures of fats, oils, and sweets in the pyramid tip or the bowl base to call attention to this group; however, this would mean eliminating the symbols, which would eliminate the potential for communicating the second message.

As expected, the use of pictures of fats, oils, and sweets more easily conveyed the subconcepts of limiting total fat and added sugars. For the overall sample population, scores were significantly higher on the limit total fat concept for the pictures in the pyramid graphic (pyramid,  $p < .001$ ; pictures,  $p < .001$ ). These results were consistent across all of the subgroups examined. The fats, oils, and sweets pictures also were marginally related to higher scores on the limit added sugars subconcept, including a significant result in the group of children receiving free and reduced-price lunches. However, for both of these subconcepts, the pyramid shape was a stronger predictor of high scores than the use of the food pictures. This indicated that the greater complexity of the symbols did not interfere with communicating the very important messages of limiting total fat and added sugars. In fact, that message was better communicated by the pyramid shape than by either the pictures or the symbols.

The fat and added sugars distributed throughout the graphics were intended to represent food sources of these components. As would be expected, these subconcepts were not communicated when the pictures of fats, oils, and sweets were used instead of the fat and added sugars symbols. The use of the symbols in the pyramid graphic resulted in significantly higher scores on both subconcepts--food sources of fat and food sources of added sugars--for the entire sample population (pyramid,  $p < .05$ ; symbols,  $p < .001$ ). These results were consistent across all population subgroups examined. For these subconcepts, the symbols were the most significant predictors of higher scores.

The subconcepts were combined to form an overall score for communication of the moderation concept. The highest total scores for the moderation concept were associated with the use of the fat and added sugars symbols in the various pyramid graphics for the entire sample population (pyramid,  $p < .001$ ; symbols,  $p < .001$ ). These results were significant across all of the population subgroups examined, but the shape was by far a stronger predictor of the ability to convey the overall concept of moderation than the symbols.

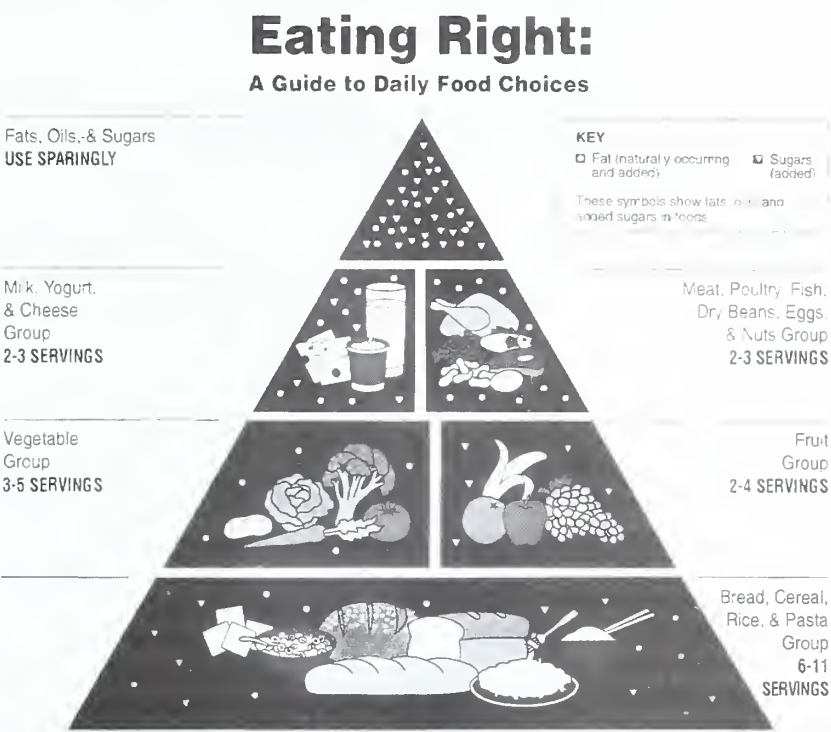
The use of the fats, oils, and sweets pictures in the pyramid graphics resulted in significantly higher scores on the proportionality subconcept of relative amounts of foods to eat from the food groups. This was true for the entire sample population (pyramid,  $p < .001$ ; pictures,  $p < .001$ ), and the findings were consistent across most of the population subgroups examined. Again however, the shape was a stronger predictor of high scores than were the pictures. Similar results were found for the overall measure of proportionality.

As part of the study, the use of a symbol to represent only fat was considered. From a health perspective, moderation of total fat is a more important message to communicate than moderation of added sugars, so eliminating the sugar symbols might simplify and focus the message on fat. However, initial analysis of the questionnaire results strongly indicated that removal of the added sugars symbols did not enhance communication of the moderation message. The conclusion was to use symbols to represent both fat and added sugars.

The comparison of symbols versus food pictures clearly indicated that the use of the fat and added sugars symbols in the pyramid graphic conveyed the most information. The results for two of the subconcepts--food sources of fat and food sources of added sugars--showed that more information was conveyed by the use of the fat and added sugars symbols. While the food pictures resulted in higher scores on the subconcepts of limiting total fat and added sugars and of relative amounts of food to eat, the pyramid shape--rather than either symbols or pictures--was more strongly associated with delivery of these messages.

**Background color:** The use of a black or multicolored background did not have a significant effect on the ability of the graphics to convey information. The contrast between the black background and the white fat and added sugars symbols appeared to enhance people's ability to observe the symbols. The multicolored background was associated with some increased reporting of the "use

Figure 4. Example Graphic Shapes Tested in Quantitative Phase



**Table 13. Graphics Research--Quantitative Phase--Scoring System  
for Testing Effectiveness of the Graphics**

Key Concepts	Subconcepts	Weight <sup>1</sup>
Variety	• Names of food groups	1.00
Total		1.00
Proportionality	• Relative quantities of foods to eat	.70
	• Number of servings	.20
	• Daily frequency	.10
Total		1.00
Moderation	• Limit total fat	.53
	• Food sources of fat	.27
	• Limit added sugars	.13
	• Food sources of added sugars	.07
Total		1.00

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<sup>1</sup> Weight Indicates relative importance of the subconcept in developing the total concept score.

**Table 14. Graphics Research--Quantitative Phase--Scores<sup>1</sup> for Concept  
Communication, Entire Sample**

N=	PYRAMID			BOWL		
	Symbols <sup>2</sup> 613	Pictures 604	Total 1,217	Symbols <sup>2</sup> 605	Pictures 592	Total 1,197
<b>Variety</b>						
Total	86	83	85	88	85	87
<b>Proportionality</b>						
Relative proportionality	34	42	38	30	32	31
Number of servings	67	68	68	62	62	62
Daily frequency	23	24	24	30	28	29
Total	40	46	43	36	38	37
<b>Moderation</b>						
Limit total fat	36	42	39	26	33	30
Food sources of fat	34	9	22	32	7	19
Limit total sugar	41	41	41	33	34	33
Food sources of sugars	38	5	22	35	4	19
Total	36	30	33	29	24	27

Bell Associates, Inc., 1992

<sup>1</sup> Scores range from 0-100.

<sup>2</sup> Respondents who were shown bowl or pyramid with fat symbols only are not included.



sparingly" text related to intake of fats, oils, and sweets. The decision to use the fat and added sugars symbols made the black background a more desirable choice. The black background also has the advantage of being easier to reproduce.

**Preference and effectiveness:** The final question in the interview was concerned with the respondent's preference for the pyramid or bowl shape. Across the entire sample, more individuals favored the bowl (49.2 percent) than the pyramid (44.4 percent). While the difference was small, it was statistically significant ( $p < .01$ ). The pyramid was more likely to be selected as the preferred graphic by the more educated, higher income subgroups of the sample. When respondents provided the reasons for their choices, over 20 percent of those who selected the bowl said they did so because it is food related. Despite preference for the bowl, the pyramid remained more effective in communicating the intended graphic messages among the lower income, less educated respondents as well as in the entire sample. However, the scores for the entire sample, but especially for the grade 2 and 3 children, strongly suggest that the graphic must be supported by explanatory materials.

## Conclusion

The research led to the conclusion that the pyramid graphic with fat and added sugars symbols and a black background would be the most effective in communicating the key food guide concepts. Concerns about misinformation or lack of preference were allayed. All subgroups of the sample population, including those of different ages, ethnicities, and education and income levels, responded in a similar fashion.

## VI. USES OF THE NEW FOOD GUIDE PYRAMID

The new "Food Guide pyramid" was released by Secretary Edward Madigan at a press conference on April 28, 1992. This event was widely covered by the media. Along with the release of the graphic, a 32-page consumer brochure was issued that describes the food guide and how to use it. Initial stock of the brochure was quickly exhausted, and a reprint was issued several months later. The brochure, "The Food Guide Pyramid," continues to be in much demand (USDA/HNIS, 1992).

Shortly after the Pyramid graphic was released, a condensed version of the booklet--"The Food Guide Pyramid...Beyond the Basic 4"--was released in cooperation with USDA by the Food Marketing Institute, who

distributed it through retail grocery markets (Food Marketing Institute, 1992b).

The pyramid graphic will also be included in some USDA publications, soon to be released, targeted to teens through health education teachers (USDA/HNIS, 1993a), low-literate audiences (USDA/HNIS, 1993c), older adults (USDA/HNIS, 1993b), and for general audiences (USDA/HNIS, In press). Other materials include posters, short videos, and slides. These materials and the negatives and artwork for the publication will be made available to health professionals, educators, textbook publishers, professional and trade associations, and the food retail and food service industries for use in classrooms, grocery stores, WIC clinics, Food Stamp Program offices, worksite wellness programs, and media presentations.

Several public and private sector groups have started using the "Food Guide Pyramid." For example, Wegman's Food Markets launched a reformulated line of breads and a new packaging program tied to the "Food Guide Pyramid." A detailed explanation of the Pyramid and what constitutes a serving of bread is on the back of the package. Campbell Soup Company included the Pyramid in a teacher's guide to help teachers integrate the Dietary Guidelines into school curricula. Pepperidge Farm will reprint the "Food Guide Pyramid" booklet and distribute it through their nutrition education programs. Kellogg's is planning to use the "Food Guide Pyramid" in promotional materials for their breakfast cereals. Several major food companies have plans underway to use the "Food Guide Pyramid" on their product labels.

The American Medical Association (AMA) will replace the "Four Food Groups" with the "Food Guide Pyramid" in future textbook editions. In a cooperative effort with the Society for Nutrition Education, McDonald's Corporation will include the Pyramid in a series of public service announcements to be aired on Saturday mornings on the CBS television network this fall. They are also developing a nutrition brochure and a teacher's guide along with a 15-minute video.

USDA wants to cooperate with others in the public and private sector to promote the "Food Guide Pyramid." The graphic is expected to be in use for many years in food guidance materials and programs. USDA will update the goals and research base for the "Food Guide Pyramid" as needed.

**Table 15. Graphics Research--Quantitative Phase--Significant<sup>1</sup> Graphic Features in Concept Communication by Subsample**

	Entire Sample	Minority	Free/ Reduced- price Lunch	Food Program	Low Income
N=	2,414	1,317	549	255	588
<b>Moderation</b>					
Limit Total Fat	pyramid/ pictures	pyramid/ pictures	pyramid/ pictures	pyramid/ pictures	pyramid/ pictures
Food Sources of Fat	pyramid/ symbols	symbols	symbols	pyramid/ symbols	pyramid/ symbols
Limit Total Sugar	pyramid	pyramid	pyramid/ pictures	n.s.	pyramid
Food Sources of Sugar	pyramid/ symbols	symbols	symbols	symbols	symbols
<b>Total</b>	pyramid/ symbols	pyramid/ symbols	pyramid	pyramid/ symbols	pyramid/ symbols
<b>Proportionality</b>					
Relative Proportionality	pyramid/ pictures	pyramid/ pictures	pyramid/ pictures	n.s.	pyramid
Number of Servings	pyramid	n.s.	pyramid	n.s.	n.s.
Daily Frequency Program	bowl Income	bowl	n.s.	n.s.	bowl
<b>Total</b>	pyramid/ pictures	pyramid/ pictures	pyramid	n.s.	pyramid
<b>Variety</b>					
Variety Score	bowl/ symbols	symbols	n.s.	n.s.	symbols
<b>Misinformation</b> -- significant features noted related to lower misinformation scores					
Shape Inversion	n.s.	n.s.	n.s.	n.s.	n.s.
Shape Interference	pyramid/ pictures	pyramid	pyramid/ pictures	pyramid	pyramid
Icon Counting	bowl	bowl	n.s.	n.s.	n.s.
Text & Wrong Answer	n.s.	n.s.	n.s.	n.s.	n.s.
<b>Total</b>	pyramid	n.s.	n.s.	pyramid	pyramid

Bell Associates, Inc., 1992

<sup>1</sup> All reported features significant at  $p < .05$ ; n.s. -- not significant.

**Table 16. Graphics Research--Quantitative Phase--Scores for Concept Communication<sup>1</sup>, by Education Level**

	Grades 2-3	Grades 4-5	Grades 6-7	Grades 8-10	Adults <HS	Adults HS+
N=	192	200 <sup>*</sup>	193	189	203	241
<b>Moderation</b>						
Pyramid	14	29	37	49	38	48
Bowl	14	22	32	37	31	39
<b>Proportionality</b>						
Pyramid	13	33	42	53	39	53
Bowl	14	28	38	45	41	49
<b>Variety</b>						
Pyramid	75	87	88	87	88	90
Bowl	79	90	90	91	88	90

Bell Associates, Inc., 1992

<sup>1</sup> Scores for graphics with fat and added sugars symbols, scores for graphics differing in background color were combined. Scores range from 0-100.

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